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LIBYAN FRONTIERS

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THE object of these notes is to review the conditions under which an Italian or German–Italian army must fight in North Africa. Clearly the troops opposed to that force must contend with much the same difficulties, but I propose to examine the situation as far as possible from the enemy's point of view.

Libya, as an Italian possession, has been created within recent years. The Italians appeared on the coast in 1911, when the war with Turkey (1911–12) gave them a footing in Cyrenaica and Tripolitania. Little reconstruction had been effected when the Great War broke out, and in due course Italy joined the Allies, Turkey throwing in her lot with Germany and Austria.

In view of surviving Turkish influence, Arab hostility, and German assistance and propaganda, the Italians found their new possessions so serious a liability that they were almost driven out of them. Repercussions were felt in the adjoining Egyptian deserts, in Darfur, and in French territory. In the northern deserts the Senussi campaign followed, in the south Darfur was occupied and added to the Anglo-Egyptian Sudan, and the French ultimately strengthened their hold on the Sahara. Considerable numbers of allied troops were retained in Africa when their presence elsewhere would have been welcome.

The post-war period saw Italy still striving to tighten her grip on the hinterland of the new African possessions, while tranquillity was already restored to the western desert of Egypt and to the western Sudan. In those years Italian troops suffered severely in bitter conflicts in which few of the advantages were on their side.

The emergence of a keener national feeling in Italy brought a change to the progress of affairs in Africa: modern weapons, mechanization, and road making overcame Arab resistance in the coastal highlands. A policy of subjugation of the native went hand in hand with the planting of Italian farms in already suitable lands, and the creation of prosperous farming land in terrain once arid or ruined but now irrigated by Italian engineers.

With growing confidence Italy looked inland and to the frontiers. Jaghbub,[1] an oasis on the Egyptian frontier, was claimed from Egypt, exchanged for minor modifications on the frontier near the coast, and occupied by Italian troops in 1926: it was fortified.

In 1930 Italy struck at Kufara, a remote oasis in the southern desert and the headquarters of the Senussi sect, whence the Arab resistance had been sustained. The movement of a large mechanized force, supported by aeroplanes, across the desert was an achievement of considerable military importance. Road-making and attention to water supply played their part, but the event was marred by the sufferings of those who fled from Kufara.[2]

The capture of Kufara was an event of more than local importance. To the south lies an inhospitable desert formerly known as the Sarra Triangle, taking its name from Sarra Well in the middle of it. It is bordered on the south by Tibesti and Erdi, the northern outposts of French Equatorial Africa. The Sarra Triangle had long been regarded as a part of the Anglo-Egyptian Sudan,[3] a view with which Italy did not concur. In 1932 Major Bagnold's expedition, of which I was a member, visited the area and in due course met Italian colonial troops and units of the Italian air force at 'Ain Duwa (an important water-hole at the foot of J. 'Uweinat) and at Sarra Well: a landing-ground had been prepared at the former.[4]

In 1934 the disputed territory was handed over to Italy and the restricted frontier between Libya and the Sudan was defined. Although on the face of it Italy had gained "only some more blazing desert" in fact she reaped important military advantages to which I shall refer later. This was not the end however, for in 1935, by a Franco-Italian arrangement, Italy acquired in particular a broad strip of territory running from Tummo south of the former Sarra Triangle to the Erdi Hills: it included a part of the Tibesti mountains, the northern approaches to the Chad Basin, and most of the Erdi Hills, bordering on the Anglo-Egyptian Sudan. Again the potential military advantage to Italy was considerable.

To put the matter briefly, it is true to say that so long as Italian domination extended no farther south than the northern oases of Libya, and so long as Kufara and its southern approaches were not in Italian hands, any threat to the Nile valley was limited in the first place, within reasonable chances, to northern Egypt: Italy's acquisitions since 1930 extend the possible theatre of operations throughout the length of Egypt into the northern and western Sudan and the Chad Basin. All this had resulted from a skilful march on Kufara, and from British and French conciliation: in accepting the new frontiers Italy specifically renounced all further territorial claims in the south and east, and those which she regarded as satisfied by the new frontiers were

[1] The spelling of the place-names in the text is based on common usage: that on the maps follows P.C.G.N. principles.

[2] A useful account of this campaign is given by Major Bagnold in 'Libyan Sands,' London, 1935, pp. 241–51.

[3] See W. B. K. Shaw, "International boundaries of Libya," *Geogr. J.* 85 (1935) 50.

[4] See R. A. Bagnold, "A further journey through the Libyan Desert," *Geogr. J.* 82 (1933) 103, and subsequent papers concerned with this expedition published in the *Journal*.

based chiefly on the right of conquest of somewhat nebulous and extensive Turkish territories.

Libya having been conquered and its frontiers pushed as far as Britain, Egypt, and France would allow, attention became focussed on internal development to make Tripolitania and Cyrenaica suitable for mass immigration of agriculturists from overcrowded Italy. Preparations have been carried out on an astonishing scale for some years,[1] and Italy has staked her claim to a place in North Africa not only by its conquest but by populating it. She can leave the rest to the national impulse to raise large families.

To maintain this agricultural population and to allow it to breed with some chance of survival for its natural increase, the whole of the equipment of a modern state had to be imported. None of these things could be done without water in an arid land: the highlands of Tripolitania and Cyrenaica have a considerable rainfall, but the lower slopes and maritime plain needed irrigation, fixation of sand dunes, and many other operations. Successful deep borings have provided locally superabundant supplies of water in Tripolitania, though in Cyrenaica, apart from the highlands and some valleys, conditions are still somewhat difficult.

The primary needs of the colonists had been met, and preparations had gone far for another mass immigration when Italy entered the war in 1940. Communications demanded attention: railways had been pushed out on a modest scale from Tripoli and Bengazi, but recent progress in reclamation and settlement, as well as higher policy, demanded a coastal road from the French to the Egyptian frontiers, an outstanding achievement which was finished shortly before the outbreak of war. There are other first and second class roads running into the interior. Although the indigenous population went through much suffering and hardship, the material achievements of the Italians in northern Libya in recent years have been remarkable and of a progressive nature: latterly the natives have been invited to participate in this progress. Some imports, including manufactured goods, oil and petrol, are essential.

The defence of the colony has passed through two stages, first internal security and the defeat of the hostile population, secondly the erection of frontier defence in depth against the French and Egyptian frontiers. It had been supposed that Libya would need to be defended against inroads from east and west, possibly from the south, and from coastal attack. On the west and along the coast fortresses have been built.[2] In the south a number of oases constituted outposts, but it might be supposed that the vast distances and the desert would form the main defence of the colonized coastal belt and highlands. On the east wells and oases, *e.g.* Jaghbub, were fortified, long wire fences erected, redoubts such as Fort Capuzzo constructed, and the coastal zone around Bardia and Tobruk prepared for defence. The main

[1] See E. J. Russell, "Agricultural colonization in the Pontine Marshes and Libya," *Geogr. J.* 94 (1939) 273, and Italian literature cited therein. Interesting accounts are given by G. L. Steers, 'A date in the desert,' London, 1939; and M. Moore, 'Fourth share,' London, 1940.

[2] A brief but useful account of these is given in the *Bulletin of International News*, vol. 17, No. 15 (27 July 1940), p. 925.

defence must clearly lie on the coast and in the highlands of Tripolitania and Cyrenaica, on account of the nature of the ground and of the fact that here alone are water supplies in sufficient quantity to maintain large numbers of troops.

It is probable that the Italian High Command regarded the prospects with little favour. The collapse of France changed the whole situation, and Italy did not enter the war until that event was imminent. In a single day therefore the Italian forces in Libya and Italian East Africa became a menace to Egypt and the Sudan. It must be remembered that this event took place in summer, when military operations in North Africa are almost impossible, that Italian forces in the Tripolitanian region had to be transferred to Cyrenaica to become effective, that such transfer could not be effected immediately along a single coastal road and some inland tracks, and that water supply might not be available for them in summer in the new concentration areas if they were so transferred.

There was bound to be a long pause before Italy could make use of the strategic advantage, for geological and geographical as well as for military reasons. Moreover the domination of the Mediterranean by the British Navy enabled Egypt to be reinforced at this stage by the Mediterranean as well as by the Red Sea, whereas the passage from Italy to Libyan ports was hampered.[1]

During the enforced pause the Italian East African army, which is capable of reinforcement only by air so long as the Nile valley is held, has seized Kassala on the edge of the Sudan plains; French Equatorial Africa has declared its independence of the Vichy Government, thus providing with the Sudan a potential southern theatre of operations for Libya once more, and the future of French West Africa and other territories is uncertain. What, then, is the position of Libya in large-scale operations on its eastern borders? The following considerations of climate, ground, water supply, and communications provide a part of the answer.

Climate

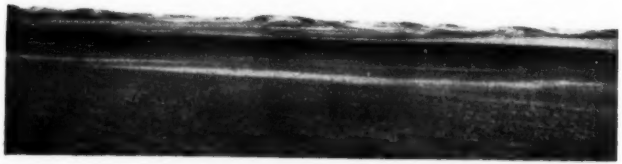
In the intense heat of summer, troops, even natives of the country, are liable to numerous infections and ailments which are reduced to vanishing point in winter: they suffer from exhaustion, heat-stroke, and the like, and they need more water in summer than they do in winter. In fact the human machine is hard pressed in these regions in summer, whereas in winter it is at its best, and is likely to suffer from cold rather than heat.

Machines also feel the heat: exposed metal gets too hot to touch with bare hands, engines overheat, and water-cooled systems boil, though the fitting of condensers conserves water. Rubber tyres also feel the heat, and wear and tear in many ways is enormously greater in summer than in winter not only on machines but on crews.

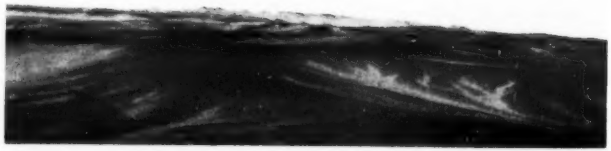
Winter brings rain storms to the coast and coastal highlands of Libya and

[1] The *Bulletin of International News* (*ibid.*, p. 929) gives the normal establishment in Libya as two white and one native army corps, which had already been doubled in 1939; and computes a strength with military workers, available peasant immigrants, and native irregulars, of 120,000 in 1939. The troops are highly mechanized.

Mediterranean coast of the Western Desert of Egypt, the sea on the left



Gravel plains, Western Desert



Dissected gravel plains, Western Desert

Sand dune belt between Kufara and 'Uweinat, Southern Libya

The new road, near Tobruk

Interbedded hard and soft sediments, Western Desert

Egypt, and especially in the latter fairly constant northerly to westerly winds. The winds at times raise severe sand storms, and mirage may be bad, but on the whole probably not so bad as in summer. The daylight is somewhat shorter in winter than in summer and there is therefore more latitude for the multitude of military activities that go on by night.

Winter is therefore as obviously the campaigning season in North Africa as is summer in Europe, and there is no need to labour the point further. In the special conditions of 1940 troops had to be concentrated, late in summer if possible, both from Tripolitania and elsewhere into Cyrenaica and eastern Libya and from other regions into western Egypt and the Nile valley.

Geology and topography

I propose now to deal with some of the problems first of topography and surface conditions, and secondly of water supply, as they may appear to the Italian staff. Throughout the whole length and breadth of the Libyan Desert topography is intimately related to the nature of the rocks exposed. The result of this close relationship is extremely important from the military point of view. Thus, hard sandstones produce outstanding plateaux and as a general rule their margins form steep scarps trenched by precipitous-sided wadis, for example Ennedi, Erdi, and the Gilf Kebir. Thick limestones produce very similar country. Soft sandstones and pebble beds form broken country, interminable plains, undulating or flat as a billiard table. Clays, shales, and other soft beds are the peculiar prey of the winds and are scooped out to form gigantic hollows in the desert surface. Beds may retain their character over thousands of square miles or may change laterally, say, from hard sandstone to soft clay; but provided a bed remains uniform its thickness and direction and amount of inclination (dip) set the order of magnitude of the resulting physical features. Structural breaks, folds, and other geological accidents impose local modifications of these general principles.

If these general rules are borne in mind it is possible to define the topography of the entire area: moreover, since rocks may usually be relied upon to produce similar physical features wherever they occur, a reasonable prediction of type of surface can be made if geological and topographical maps are studied side by side. The following is a brief analysis based on a general view of the ground, with some conclusions that might legitimately be drawn from it.

The southern and south-eastern frontiers. The southern frontier crosses the northern part of the Tibesti massif, an intricate network of peaks, isolated plateaux, and deep rocky valleys, mostly cut in crystalline rocks and hard sandstones, an excellent place for mountain warfare of the old-fashioned sort, but generally speaking not well suited to mechanical transport. To the south-east, beyond the foot of the mountains, lies a plain of crumbling sandstones and softer beds, with here and there low sandstone plateaux and scarps nowhere more than a few hundred feet above the general level of the country. In Libya this type of open desert stretches almost unbroken from the Mediterranean to the southern frontier, breaking down over enormous areas into utterly featureless pebbly plains.[1] South of the frontier it continues toward

[1] See, for example, Hassanein Bey, "Through Kufara to Darfur," *Geogr. J.* 64 (1924) 273, and 'The Lost Oases,' London, 1925, also A. Desio, "Missione scientifica della

the heart of the Chad Basin, and south-eastward across the north-western Sudan to the Nile valley. Thus there are two wide corridors from Libya, and from Kufara in particular, separated by the high sandstone hills, deeply trenched by valleys, of Erdi and Ennedi. These two hill groups are separated one from the other by a broad trench running east and west, the Murdi Depression, which connects the plains of the north-western Sudan with those of the northern end of the Chad Basin. The hills are not suitable for mechanical transport, but the plains are, on the whole, well suited to it.

A commander in Libya might conclude therefore that he had direct, broad, and easy routes for his fighting vehicles to the Sudan and to Chad. But he has to contend with enormous areas of sand and sand dunes not only in his own country but in the adjoining territories.[1] The dunes may stop progress or cause wide detours; other forms of accumulated sand, even if they make good going, throw a good deal of sand into the machinery in the flying clouds that any considerable number of vehicles raise: in either case delays and excessive wear and tear result. Visibility of vehicles and their tracks from the air, supplies of oil, petrol, and water to carry a force over these enormous distances, adequate support and reinforcement, these and many other factors must weigh heavily upon the mind of a commander who considers an advance, across these deserts.

The eastern frontier. This may be taken to run from 'Uweinat to the Mediterranean. 'Uweinat is a great massif of crystalline rocks capped by thick sandstones, a high and rocky island in the sea of the Libyan plain already described. Although it stands partly in Egyptian territory its position remote from Egyptian and Sudanese oases and wells places it initially, from a strategic point of view, in the Italian sphere. Arkenu, a lesser massif of the same sort, lies not far to the N.N.W. on the Kufara road; isolated peaks like J. Kissu and lesser hills also lie to the east and south of 'Uweinat.

The military importance of 'Uweinat is considerable: broad valleys lead far into its interior, with steep sides and rocky slopes in some places riddled with natural caverns; it is a place suitable for the concealment of stores and vehicles, with water available in limited quantity, a beacon and rallying-point for all to see from afar. The adjacent plains in some areas are suitable for landing-grounds—as already observed in 1932. There is no topographical obstacle between 'Uweinat and the Nile valley, over 400 miles away, or between it and Kufara. The isolated hills and mountains around it are natural outposts.

A hundred miles or so to the north and north-west of 'Uweinat lies the great sandstone plateau-mountain of the Gilf Kebir (the subject of several papers in the *Geographical Journal*), and between the two lie broad sandy plains and broken country. The Gilf Kebir lies nearer to Kufara than it does to the Egyptian oases of Dakhla and Kharga, and it too is pierced by broad,

Reale Accademia d'Italia a Cufra (1931–IX)," *R. Accad. Italia, Viaggi di Studio ed Esplorazioni*, vol. I, 1935, and II, 1939, and "Le nostre conoscenze geologiche sulla Libia sino al 1938," Instituto di Geologia, Palaeontologia e Geografia fisica della R. Universita di Milano, Ser. G.-Pub. No. 10, 1939, which contains a valuable geological map of the whole of Libya.

[1] See map in R. A. Bagnold, "A further journey through the Libyan Desert," *Geogr. J.* 82 (1933) 103

steep-sided valleys which narrow toward their heads: it appears to be without water, but otherwise possesses most of the military attributes of 'Uweinat.

The Gilf loses altitude northward and its northern end marks the southern limit of the Sand Sea, a formidable obstacle that stretches along and S.S.W. across the frontier from Jaghbub and Siwa oases far into Egyptian territory. Beneath it disappear two important topographical features, the scarps that run W.N.W. from Kharga oasis. A great limestone scarp also continues southward from Kharga for about 300 miles, dominating the sandstone plains of south-west Egypt, then turns toward the Nile valley which it approaches at Aswan, only to turn northward so that it meets the river near Luxor.

We now come to the vexed question of the function of sand dunes, and the Sand Sea in particular, as military obstacles. The first and obvious remark is that sand dunes, even those of the Sand Sea, have been crossed by motor vehicles. Prince Kemal ed Din showed that it could be done with track vehicles, and most of the members of the Zerzura Club have done it at various times with ordinary Ford cars and a good deal of hard pushing. Bagnold and his friends evolved a technique which enabled them to cross the Sand Sea and, at a later date, almost as formidable obstacles in the Sarra Triangle and elsewhere, near Sarra Well under the interested observation of Italian officers.

There are some types of soft sand which will probably defeat any wheeled vehicle, however skilful the driver, but hard-packed dunes can be crossed, as well as other forms of sand accumulation, and improvements of vehicles and equipment will facilitate such operations. Let it be admitted, then, that most types of sand can be crossed by suitable cars properly driven.

The Sand Sea, for much of its great length, consists of huge, narrow, perfectly aligned dunes running about N.N.W.–S.S.E. in countless rows, each dune running maybe for many miles without a break.[1] Between these formidable barriers are corridors, frequently swept clear of sand, which over considerable areas provide good going for cars. This area is, then, primarily an obstacle to east–west traffic (or west–east), but each great dune can, with skill, be crossed in turn.

A distinction must be made however between the performance of a few cars with skilful drivers and enthusiastic teams, and the chances of a considerable number of vehicles, with possibly less foolhardy crews. Moreover no matter what type of vehicle is used the passage of each renders more difficult that of its followers, since the hard-packed sand gets disturbed: other crossing places must be found. What is possible for the few is not necessarily a feasible military operation, and there are probably few of us who would care to attempt this particular feat in war unless local air superiority were guaranteed.

North of the Sand Sea lies a critical region of varied geology and topography which may be described as follows :

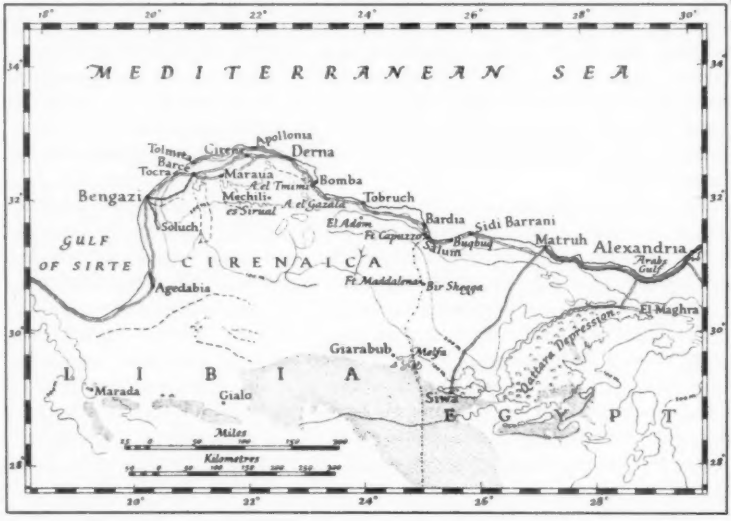
(1) West of Sollum the margin of a limestone plateau forms the coast: the plateau stretches beyond Tobruk and broadens eastward into Egypt, but south-west of Tobruk gives place to a broad lowland. This stretches to the

[1] Major Bagnold has contributed a series of papers on the dunes and other accumulations of sand in the Libyan desert, published for the most part in the *Geographical Journal*.

shores of the Gulf of Syrte, with the Cyrenaican highlands on the north and the Libyan uplands rising steadily southward, to pass, with some broken country, into the gravel plains of central and southern Libya. Near the 29th parallel on the Libyan upland lie the oases of Marada and Jalo, and east of the latter lie the confused sands, reaching far into Egypt, which form the northern end of the Sand Sea.

(2) North of this sand dune area lie discontinuous lowlands from Jaghbub eastward, for the greater part below sea-level: from Melfa and Siwa oasis to the enormous Qattara Depression[1] and Moghara oasis, less than 50 miles south of the coast of Arabs Gulf. Much of this depressed area is occupied by salt marsh (*sebakha*), with wide expanses of soft clays, sand, and gravel.

(3) The margins of the depressions are formed of steep limestone scarps



or broken hills, and to the north lies the high plateau (mostly above 600 feet) which runs from the region of Tobruk eastward, broadening inland of Sidi Barrani to Mersa Matruh, and then narrowing off between Arabs Gulf and Moghara oasis.

(4) The plateau ends fairly sharply along the Mediterranean coast east of Sollum and a coastal plain lies at its foot. The plain is generally about 10 miles wide, but narrows between Sidi Barrani and Mersa Matruh. Around the shores of Arabs Gulf the plain not only broadens but merges imperceptibly into the upland plains of limestone and gravel in which another depression, Wadi Natrun, has been carved. Along the coast west of Alexandria ridges of consolidated white lime-sand lie between the shore and the seaward limit of the plain, which is thereby concealed from direct observation from the sea.

What conclusions as to ground can be drawn from these topographical

[1] See J. Ball, "The Qattara depression," *Geogr. J.* 82 (1933) 289.

divisions? It emerges first that the region north of the Sand Sea is a self-contained unit and that there can be little direct cohesion between operations in the north and along or south of the Sand Sea. Secondly, the narrow lowland between Jaghbub and the Qattara Depression, hemmed in on the south by the sand dune area and on the north by the plateau, and floored with salt marsh, clay, and sand, appears a poor place to soldier in unless the possession of the northern plateau is guaranteed. Thirdly, the possession of the northern rim of the plateau dominates the coastal plain from the south and the command of the sea controls it from the north. The key, then, seems to be the plateau, so far as ground is concerned.

Water supply

Even if war is a matter of machinery, which with efficient condensers may need little water, men must still drink, and on the whole water is the most convenient liquid for the purpose. Moreover a mechanized war means fabulous consumption of oil and petrol, which must be distributed throughout Libya: it is reasonable to suppose that camels will be used for such purposes, especially in back areas, and even camels must drink. On considerations of ground, therefore, must be imposed those of water supply, and it is probable that in these parts as many armies have been conquered by thirst as by their enemies. But water supply, though it is clearly of critical importance, must be dealt with on general principles here, since more detailed consideration involves technicalities which are beyond the scope of the present review.

The following seems to be a fair statement:

(1) In the highlands and mountains there are water-holes and water sources resulting from direct accumulation of rain, *e.g.* in Tibesti, Erdi, Ennedi, 'Uweinat, and Arkenu, where they are few, and in Cyrenaica, where they are numerous and prolific.

In Cyrenaica and in the highlands of Tripolitania, as along the length of the African coast of the Mediterranean where rains occur, man-made rock cisterns of great antiquity supplement or replace the natural water-holes, springs, and the like. Large reservoirs and tanks of later and recent date have been provided.

(2) Over most of the Libyan Desert there is little or no rainfall for years at a stretch and the rocks are entirely desiccated in some places to great depths. It is obvious from the occurrence of oases that there is sub-surface water beneath the whole area,[1] and its presence has been proved by well-digging in places remote from the oases. In the western desert of Egypt static water contours have been drawn, based on the available information, and it is possible to predict the depth at which water may be found, though not the quantity, at any place of which the altitude of the surface of the ground is known.[2] Much work of the same

[1] See for example H. J. L. Beadnell, 'An Egyptian Oasis,' London, 1909; and "Zerzura," *Geogr. J.* 77 (1931) 245.

[2] See J. Ball, "Problems of the Libyan Desert," *Geogr. J.* 70 (1927) 21: these contours have also been continued into the north-western Sudan and the Sarra region (K. S. Sandford, "Sources of water in the north-western Sudan," *Geogr. J.* 85 (1935) 412).

sort has been done in Libya, and with outstanding success especially in Tripolitania.[1]

Boring for deep-seated water is therefore an adjunct of the military machine in Libya and Egypt, and the yields of successful wells may be sufficient to dispose of the problem of water supply in their vicinity. Shallow natural sources, on the other hand, are liable to exhaustion in the arid regions; they may be contaminated or increasing salinity may ruin them. It may be well therefore to reconsider the conclusions arrived at from a study of ground in the light of the water problem.

The southern and south-eastern frontiers. There are fairly numerous waterholes in the Tibesti massif, which on the whole is unsuitable for wheeled or track vehicles. This, then, may be camel and pack-animal country, suitable for the employment of small forces relying on the available water and trained in mountain warfare.

The Kufara–Chad "corridor" possesses certain fairly deep wells along the old camel road, *e.g.* Bishara and Sarra, which may be capable of improvement (perhaps already effected) to give a satisfactory yield. But such isolated wells provide slow service with bucket and rope, and the alternative—pump and tanks—implies a strain on the water resources, and may be too conspicuous from the air. The destruction of a single well on which forces depend is a risk which few commanders would take.

In French territory lie Tekro and other small oases. Here the water is at or near the surface of the ground and the yield may be good; but the waterholes are surrounded by wide salt marshes and salt pans, and excessive interference with supplies may draw in salt water. The corridor, though passable for vehicles, is therefore discouraging so far as water is concerned. The alternative is to make troops independent of local supplies by carrying sufficient for the task in mechanized or camel water convoys: it is conceivable that on a limited scale air transport might be utilized in certain circumstances.

The territory between Erdi, 'Uweinat, the Gilf Kebir, and the Nile, much of it suitable for mechanical transport, is as dry as a bone except for a line of oases—Dakhla, Kharga, Selima, Laqia, Merga—with certain wells between them. Water in Erdi, Arkenu, and 'Uweinat being very limited, and in the Gilf probably nil, it follows that water reserves must in fact be transported from the Kufara area. Thus, unless an exceptional fall of rain has occurred recently in any of the hill groups, any operations across these enormous expanses of desert must be self-supporting, so far as water is concerned, between Kufara and the Egyptian and Sudanese oases, or else hidden reserves must be accumulated, presumably along the Gilf Kebir–Erdi line.

The eastern frontier. Water is to be found in certain localities between Kufara and Jalo, and in the Egyptian oases between Dakhla and Siwa, but between lies the Sand Sea; no problems of special interest call for discussion here, nor does the position between Jaghbub and Siwa require comment. To the north lies the plateau and the coastal plain, where wells can be destroyed by those in possession of them, and the construction of new ones is a vulnerable

[1] See A. Desio, "Cenni sull 'Idrologia" (Resultati scientifica della Missione alla Oasi di Giarabub) Reale Societa Geografica Italiana fasc. IV, 1931, p. 493, and 'Verso la Soluzione del Problema delle Acque profonde in Libia,' Rivista Libia, 1938, No. 7.

and time-taking process. It is sufficient to note that the Italians intended that Fort Capuzzo should receive water by pipe-line, that special efforts have been made to supply Tobruk from one or more deep bores (the supplies having in the past been barely sufficient for the needs envisaged), that Italian consolidation of Sollum and Sidi Barrani entailed new plans for water supply, and that these difficulties are unlikely to decrease with any further advance.

One must conclude that the campaign, wherever it may be fought, is dominated by water supply, and since water must be transported where it cannot be piped, it is inevitably linked with the whole question of transport of all other supplies.

Conclusions as to limitations imposed on supply and on disposition of troops

The war in the Libyan Desert is fettered to geology: space, topography, surface conditions, water, these impose a burden on transport that would seem to make large-scale operations almost impossible under modern conditions.

The campaign, whatever it may be, must be undertaken in winter. It would appear to be impossible to dispose large numbers of troops for any length of time in positions remote from permanent and copious sources of water and from other facilities such as are provided in the inhabited parts of northern Libya.

In the field the outflow end of a pipe-line is as good a source as the intake end, so long as the pipe is not cut or destroyed, and distribution can be effected from it: so far as water is concerned, and perhaps also liquid fuels, road-making and transport can be economized by the length of the pipe. It is likely therefore that the Italians will make exceptional use of pipe-lines for long-range distribution.

The campaign would demand the maximum use of mechanization to achieve speed of action over the distances involved, striking power, and economy of men and animals needing supplies. But mechanization on this scale, and use of aircraft to match, implies enormous consumption of oil and petrol, and consequently not only further transport problems on land but, for Italy, replenishment by sea.

The part to be played in Libya by air observation and attack is perhaps not yet fully known. The rôle so far seems to be divided between observation and support of ground troops, and attacks on troops and bombing of back area objectives concerned with their supply, aerodromes, and the like. In these barren lands it is difficult to hide tracks, even of single vehicles, unless they are moving over hard ground, but it is evidently not easy to observe stationary or camouflaged vehicles or well-concealed field works. Bombing does not seem likely to prevent the prosecution of a campaign, forwarding of supplies, or road construction, though it may gravely interfere with them. It remains to be seen whether other methods adopted by Germany, *i.e.* parachuting of troops and troop carrying by air on a large scale will now be tried in the peculiar conditions of North Africa.

To conclude, it seems that the following propositions may present themselves to the Italian command ***while it retains the initiative:***

(1) Raids by fighting vehicles and aeroplanes into French territory, southern

Egypt, and the Sudan from the region of Kufara and 'Uweinat, possibly on the lines of the advance on Kufara in 1930: such might synchronize with attempts to move westward from Italian East Africa or Kassala: the problems and distances involved even in a raid to the oases are enormous, and failure might lead to a disaster.

(2) The Sand Sea, though not a complete obstacle, is not an encouraging route for the invasion of Egypt.

(3) The only region in which a campaign may be prosecuted step by step on methodical lines appears to be in the north and along the coast, where at any rate the Italians know some of the difficulties and may get small comfort from envisaging others.

Note on photographs: the last two are from Italian sources, the rest were taken by my wife or myself. K.S.

DISCUSSION

Before the Paper at the Opening Session on 4 November 1940, the CHAIRMAN (Admiral Sir WILLIAM GOODENOUGH) said: We have no intention whatever of allowing the very important, and I may say entertaining, business of holding meetings in the Society's House to be interrupted. I would beg that all will urge present Fellows, intending, and prospective Fellows that they shall come here and assist us to keep our great work going.

Major Sandford, who opens the Session with a paper on "Libyan Frontiers," is a geographer and geologist of the University of Oxford and a member of our Council who has made many journeys in the Libyan Desert, has studied the recent work of Italian scientists there, and will try to envisage the problems of operating on those frontiers as they must appear to the other side. You can well imagine that the Libyan frontier is at this moment a matter of the greatest possible importance.

Major Sandford then read the paper printed above.

The CHAIRMAN: I do not propose to invite discussion. There are a certain number of staff officers present who would be glad to get from Major Sandford the information and knowledge which he has, and I hope they will remain to talk with him. It may be that he will be able to speak more freely to those officers than he or they would be able to speak from this platform.

I am particularly sorry that the President is not with us, for he is not only a soldier but a very distinguished soldier with consummate knowledge of his own profession and particular experience of eastern warfare, both in the Far and the Near East.

One subject which was only touched on and of which I perhaps know something is the sea frontier. Oil and all kinds of provisions and warlike munitions must be transported across the Mediterranean, and you will therefore all realize, without my giving a discourse on the importance of sea power, of what immense importance it is that we should hold predominance in those waters.

May I say to you, Major Sandford, that you have given us in very clear and definite language information which many of us have been seeking for a long time past. I and all here who have listened to your lecture with such great interest congratulate you most warmly on the lucidity with which you have stated the problems involved. I hope that you will prosecute these researches which are of such great value, and, with thanks to you, I close the meeting.

FERTILITY, PRODUCTIVITY, AND CLASSIFICATION OF LAND IN BRITAIN

L. DUDLEY STAMP

Meeting of the Society, 11 November 1940

THERE are probably few areas of comparable size which exhibit such variety of physical conditions affecting land use as is to be found within the 90,000 square miles of the island of Britain. Within the latitudinal range from the Scilly Isles in 50° N. and the Shetlands in 61° N. there are appreciable differences in length of daylight which affect plant growth and a difference of average temperature in the warmest month from 64° F. to 55° F.—a difference which effectively places the northern part of Britain beyond the economic if not beyond the ultimate limits for the cultivation of wheat. The predominantly upland character of the north and west of England, Wales, and Scotland, coupled with the influence of poor, leached, and immature soils developed upon the old glaciated rock surfaces, gives this half of the island—Highland Britain—an agriculturally negative character. There the stretches of cultivated land are of the nature of oases of greater or less extent in a vast extent of natural or semi-natural moorland which is agriculturally submarginal. On the other hand the south and east—Lowland Britain—with its gentler relief developed upon younger rocks, its deeper and richer soils, its lower rainfall and kindlier climatic conditions generally, is almost wholly cultivated and the untended moorlands and heathlands are but occasional islands in the sea of farmland. Even in Lowland Britain differences in soil result in sharp contrasts between one region and its neighbour, while there is a general transition from the predominantly arable farming of the drier eastern counties to the grassland farming of the moister midlands and west.

The War has brought into sudden prominence the urgent necessity of increasing the home output of agricultural produce, and to secure the maximum results it is essential that every acre of the country should be devoted to the production of that commodity for which it is best suited. In 1939 the acreage of ploughland had sunk below 10,000,000; it was the aim of the 1939–40 campaign to secure the ploughing up of an additional 2,000,000 acres. This is an obvious "war effort" in that the results of the ploughing are visible to all on the surface of the country, but ploughing is not an end in itself: its purpose is to add to the productive capacity of the country as a whole, and by that standard alone can the effectiveness of the effort be judged.

The problem is nothing new: it was very much to the fore in 1917–19 when much unsuitable land was ploughed; it was even more prominent a century earlier when, during the Napoleonic wars and under the threat of Napoleon's invasion of Britain, the attempt to increase home production resulted in the cultivation of land which could only have been considered suitable in conditions of virtual panic. Traces of this Napoleonic period can still be seen in the outlines of ploughed fields on bleak rain-swept hillsides, and William Cobbett in the course of his "Rural rides," undertaken between 1821 and

1832, has occasion to bemoan the ruination of fine downland pastures by indiscriminate conversion to arable land in "dear-corn" times, and he notes that the corn yielded could scarcely have equalled the seed sown. On the other hand economic conditions over the past fifty years have resulted not only in the well-known and almost continuous conversion of arable to pasture but also the abandonment of some 2,000,000 acres of land once improved and farmed: land which in these times of urgent need should play a large part in increased home production.

Apart from the eradication of the bad farmer (the "C" farm, which was the immediate object of the Farm Survey organized by the Ministry of Agriculture in July 1940), what is needed, it seems, is a classification of the land of Britain into a number of types, sufficiently simple to be understood by the layman yet based on the sum total of scientific knowledge available. Under any given set of economic conditions and any particular national need the optimum utilization of each type of land should be known: production could thus be planned naturally on a regional basis and not on the basis of the artificial county unit.

Although such a land classification is the basis of successful farming in many countries of the world, and although the problem is so old in Britain, it has never been carried out here. Towards the end of the eighteenth century the newly formed Board of Agriculture and Internal Improvement set itself the task and the regional soil maps published in some of the county reports submitted to the Board between 1793 and 1815 are still the best, even the only, maps of their kind available.

The evidence available

Assuming that it is desirable to attempt a classification of the land of Britain according to its productivity and inherent fertility, what evidence is available? Further, what use can be made of the different types of evidence and how can the evidence be correlated and applied?

1. *Present utilization.* The present utilization of the land has a much greater significance in a long-settled country such as Britain than it has in one of the "new" countries such as the United States. In the latter case present utilization may reflect but the early stages of a process of trial and error: a trial in which the error is only now being discovered. In Britain much of the land has been settled and farmed for upwards of a thousand years, some of it for two thousand. The present utilization does therefore reflect the combined influence of the varied factors concerned: the physical factors of relief, soil, and climate; the more purely economic and social factors of prices, wages, labour; the historical factors of land ownership, local usage, tenure, and even tradition or custom. It is only when the attempt is made to analyse present land use by reference to only *one* set of factors that dangerous fallacies of interpretation may be promulgated.

It is fortunate that the field work of the Land Utilisation Survey of Britain was completed before the outbreak of war. The published 1-inch maps [1] present a picture of Britain in the period 1931–38 when economic factors in general encouraged the conversion of arable to grass, when the average farmer was sure of some return from milk but uncertain of an adequate return from

the sale of arable crops. During that period it is fairly safe to assume (*a*) that land which remained arable did so by virtue of qualities rendering it particularly suitable for ploughing; (*b*) that land equally fitted by physical qualities to be grassland or arable was more likely to be in the main under grass; (*c*) that land of inferior qualities, once cultivated, was likely to be submarginal and hence to be lying derelict or reverted to rough grazing.

Land utilization in the period 1931–38 forms a very convenient starting point for land classification for other reasons. It represents a nadir in British agriculture from which the war effort began and from which future land planning must start. Still more important, it is possible to distinguish certain "land-use patterns" and from these to divide each county into more or less clearly defined "land-use regions." Often the distribution of ploughland considered alone affords a guide to the regions. Fig. 1 shows the distribution of arable land on Sheet 117 (East Kent), and Fig. 2 the Land-Use Regions which have been distinguished in the same area. Taking the pattern of arable land alone, it is clear that (*a*) the Isle of Thanet is typified by large continuous stretches of ploughland; (*b*) that the northern part of the chalk dip slope, also with large continuous stretches of ploughland, is quite different from (*c*) the southern part of the chalk dip slope which has smaller patches of arable, actually occupying the more level bottoms of the dry chalk valleys or the intervening flat hill tops.

The pattern displayed by the distribution of grassland, woodland, orchards, moorland, and heathland may be similarly analysed separately and in combination, and it will be found that land-use regions begin to suggest themselves. Their existence is confirmed or refuted by a field study, and it is frequently found that each has its characteristic type or types of farming: not infrequently the distribution of selected crops or animals suggests an essential division of an area generally homogeneous in other respects. A number of counties have now been studied in this way and county maps of land-use regions drawn up [2]; most of the regions distinguished have a characteristic type of land utilization *at the present day*. One for example may be mainly ploughland growing cereal crops for sale off the farm; another may be entirely grassland used for the grazing of cattle and sheep; a third may be a mixed farming region with farms devoted both to the growing of crops and the rearing of animals.

It does not follow that the present-day utilization of any given region is the *optimum* utilization; it may not have been its utilization in the past and it may not be in the future.

2. *Past utilization.* No complete record exists of land utilization in Britain for any period in the past. Agricultural statistics, representing the summation of figures given by farmers in their returns to the Ministry of Agriculture made annually on June 4, give acreages, but the information is not and cannot be mapped, so that where changes have taken place it is now impossible to say exactly where (*i.e.* in what groups of fields) the changes have occurred, and so it is impossible to evaluate precisely the influence of physical and other factors.

For three periods in the past the information does however exist for the construction of land-use maps at least over considerable sections of the country.

In the 1870 revision of the Ordnance Survey, the field books record the acreage and other details of each parcel of land and a final column was provided headed "state of cultivation." As a measure of economy, how short-sighted may now be judged, the completion of this column was later dropped, but from the information available land use in 1870 may be mapped over considerable areas.

Between 1835 and 1849, mainly in the early 'forties, the Tithe Redemption Commission had constructed detailed maps of all parishes subject to payments of tithe and the utilization of each field was recorded, sometimes on the maps but usually simply in the MSS. record. By identifying the field number on the record with the field number on the map and the latter with the field on a modern 6-inch map, land utilization for about a century ago may be mapped, but the work is slow and laborious. It is best done by selecting sample parishes or blocks of parishes since there are always gaps representing parishes not subject to tithe if one attempts to construct a county map.[3]

Fig. 1. East Kent—all arable land shown in black

Finally, at different dates in the eighteenth century, many English counties were accurately mapped, especially by Wm. Fayden and John Rocque, on scales generally about 1 inch to 1 mile; these maps show (*a*) moorland and heath, and (*b*) woodland, with frequently (*c*) arable, and sometimes other details of utilization. Manuscript estate maps may also afford valuable sample surveys, but the small-scale maps of the medieval map makers are usually of little value.

By the careful use of this historical material, often with the corroboration of statistics[4] and contemporary descriptions,[5] it is possible to trace the history of land use in the past century or two. This has been done in a number of the Reports of the Land Utilisation Survey.[6] While it is unwise to generalize too far, the general results of these studies to date tend to show

(*a*) that there is a considerable, often remarkable, stability of land use on the best land and on the poorest land, and (*b*) that the maximum of change and fluctuation is found on land of intermediate qualities. In very many cases the medieval farmer knew those areas most productive of crops, and such they have remained despite the vicissitudes of economic conditions to the present day. The same is true of the best grasslands, the fatting pastures, whilst the "wastes" of the eighteenth-century writers remain uncultivated heaths and moorlands to the present day. Economic factors have exercised their full play on lands which at one period it has just paid to plough and crop, at another to sow down to grass, at another to abandon altogether, according to the market prices of their moderate produce.

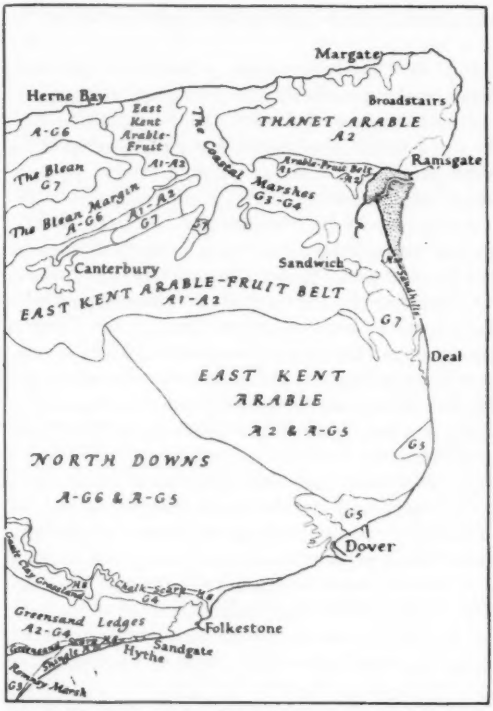


Fig. 2. East Kent, Land Use Regions as classified below

These historical studies have a very clear lesson for the present day. The traditional ploughlands are usually the best ploughlands and ought to be thus fully utilized in the war effort; poor land which has remained untilled for a century or more not infrequently shows signs of attempted cultivation in the distant past but has remained unused from its inherent poverty, and little return can be expected in the present emergency. Of course there are many exceptions: some of the finest arable of to-day has been reclaimed by drainage of moor and fen; modern methods of cultivation and improvement (such as Stapledon's treatment of grasslands [7]) can succeed where older methods failed. But taking the position in general, the cultivation history of a region is a good guide to its potentialities.

3. *Soil surveys.* Pedology is a young science and older studies which recognized only "soil" and "sub-soil" and gave chemical and mechanical analyses of the former are now regarded as inadequate.[8] Consequently modern soil surveys in Britain have been carried out over very limited areas only, and their extension to cover the whole country would require a highly

trained specialist staff to combine detailed mapping and laboratory investigation after the manner of the Geological Survey. Such a soil survey is in contemplation and would have the function of studying soils *quâ* soils and so of recording the fundamental basis on which land utilization is determined. After the delimitation of soil types and series there would remain the determination of the optimum utilization of each. Over most of Britain the most powerful soil-forming agent has long been man himself, and the action of the plough is generally to prevent the development of a normal soil profile, further hindered by such processes as draining and liming. Where natural pedogenic processes have been allowed to develop freely, the podsol is the commonest soil type.

In the present investigation each land-use region is found to have soils ranging between certain limits or dominantly of one or two major types, and the soil survey affords a convenient means of subdivision of a region.[9]

4. *Vegetation surveys.* F. E. Clements, working in America, developed the theory that natural vegetation afforded an index of the sum total of physical factors affecting land fertility and therefore that an adequate vegetation survey obviated detailed investigations of soil, climate, drainage, etc. Natural vegetation is essentially dynamic rather than static: it is constantly developing towards a "climax" type determined primarily by climate.[10] It is commonly prevented from reaching this final stage by the constant activities of man with his plough and his domestic animals or his lumberman's axe. A. G. Tansley, working in this country, has developed the idea of man stabilizing the vegetation to suit his convenience at various stages,[11] and so a survey of natural and semi-natural vegetation even in a country so completely dominated by man as Britain takes on a special significance. A primary vegetation survey of the existing vegetation of moorlands and heathlands (categories H8 and H9 below) can be used not only to subdivide a land-use region but also to indicate the potential development and improvement. Sir George Stapledon and his co-workers have carried this further by recognizing the chief types of grassland as indicating both the character of the physical factors and the possibilities of improvement. As so much of Britain is grassland a grassland survey, such as that recently carried out over England after the publication of that made in Wales,[12] is really a survey of the whole country and can be directly correlated with the Land Utilisation Survey which deals also with the very important cropped land.

5. *Fertility and productivity surveys.* In recent years many attempts have been made to measure the fertility and productivity of land and a considerable literature exists on the subject.[13] There has been some confusion of thought on the matter. Very briefly one can measure existing productivity of land by crop yields on arable and stock-carrying capacity of grass; what one really desires to measure is potential productivity (which should vary directly as the fertility of the land), but since potential productivity can theoretically be increased to fantastic levels by the addition of appropriate plant food its measurement would seem to be impossible. The extreme case is given by the use in "dirtless farming" of a fine quartzose sand or silt (serving merely as a foundation for the roots) and the addition of an optimum number of "Baule units" of balanced fertilizer, thus securing an increase in yield to ten

times the normal. It is said that a theoretical maximum yield of 225 bushels of maize per acre (against a normal yield under favourable natural conditions of 25–40 bushels) can be obtained.[14]

In measuring actual production one is measuring not only the natural fertility of the soil but also the efficiency of the farming systems and the farming community. As between one country and another, with comparable climatic conditions, unit yields such as the number of bushels per acre may express primarily the standard of farming. Within the confines of Britain only however it is reasonable to assume a general level of intelligence and standards of living amongst the farming community, and so crop yields do reflect the fertility or productivity of the land under existing economic conditions and present systems of farming.

The yields per acre of all the chief crops for each county are published annually in the Agricultural Statistics (Part I). It is possible to use the yield of any given crop, preferably one widely distributed over the country such as oats, and so to arrange the counties in order of productivity per arable acre. Mr. M. G. Kendall, of the Ministry of Agriculture and Fisheries, has devised a simple formula[15] by which the yield of ten selected typical crops can be utilized to give a composite production index (Kendall's "Ranking coefficient") which goes a long way towards providing a measure of the productivity of the different types of land in Britain. Kendall also determined "money-value" and "starch-equivalent" coefficients for corroborative purposes. The limitations are not so much in the method as in the data available. The yield figures are county figures, and where the county is a relatively homogeneous unit Kendall's results confirm the ranking which one would expect. The Isle of Ely and Holland (Lincolnshire) are at the top of the scale; mountainous moorland counties such as Westmorland well down in it. Unfortunately the typical English county is essentially a heterogeneous unit, its bounds have often been drawn so as to include some of the poorest land to balance the areas of original settlement on good land, and so the ranking of a county unit has little meaning. In the second place Kendall's method of necessity ignores pasture land and the finest of all pasture counties, Leicestershire with its famous fatting pastures, has a very low ranking; and so has Herefordshire.[16]

An obvious method of assessing pasture land is by the stock it will carry, and various formulae have been evolved for equating the requirements of horses, cattle, sheep, and other animals and determining composite "stock units." The problem is actually very difficult: practically every farm buys supplementary feeding stuffs and stock-carrying capacity then loses its meaning. However the yield of hay from both permanent grass fields and sown fields is known, and if one assumes that the growth of grass is the same on a pasture field as on its neighbour which is mown for hay an acre-yield figure can be obtained. It is understood that Mr. Kendall is experimenting with the application of his formula in this way.

Often the parish is a heterogeneous land unit for the same reason as the county is, but just as the study of carefully selected sample parishes has proved very successful in tracing the historical development of land utilization within a region, so it would seem that the study of yields in selected parishes

by Kendall's methods would give a satisfactory measure of productivity in regions determined or delineated by other means.

6. *Types of farming.* Finally, land use is profoundly affected by the type of farming. A few years ago the Ministry of Agriculture prepared a small map (for official use) of England and Wales which distinguished six types of pasture farming, six of intermediate farming, and six of arable farming, and divided the country into one hundred and twenty-eight regions on this basis. At the outbreak of the War a map on the scale of 10 miles to 1 inch, with an explanatory bulletin, was ready for publication, but has unfortunately been delayed. The map is very instructive in that it emphasizes the contrasts in types of farming between one part of the country and another and serves to show that farming problems in the east are entirely different from those in the west. It serves to stress also the influence of transport and markets: the intensification both of arable and dairy farming near populous centres. So important is this question of accessibility that the Swedish geographer, Olaf Jonasson [17] claims to be able to distinguish seven "zones of production" round large urban centres. These zones are:

I. Horticulture.
   Zone 1. Greenhouses and floriculture.
   Zone 2. Market gardening—fruit and vegetables.
II. Intensive agriculture with intensive dairying.
   Zone 3. Dairy products, fat cattle and sheep, forage crops.
   Zone 4. General farming—grain, hay, livestock.
III. Extensive agriculture.
   Zone 5. Bread cereals.
IV. Extensive Pasture.
   Zone 6. Rearing of cattle, horses, and sheep.
V. Forest culture.
   Zone 7. Peripheral areas, forests.

To some extent these zones, much modified, may be traced in Britain, notably in the high-rented market gardens near towns, the dairying (rather independently of the suitability of natural conditions) near all the great centres of population, the fattening of animals in the Home Counties and Midlands, the stock-rearing of the Highlands of Scotland and Wales.

There are numerous other sources of information which can be used in the detailed study of land-use regions, notably the parish statistics of the Ministry of Agriculture which are available for study by approved researchers. The farm survey recently undertaken by the Government should yield much detailed and invaluable information and will record local knowledge which is otherwise lost.

Summarizing, there would seem to be ample justification for the delineation of detailed land-use regions based on the existing land-use pattern (itself a reflection of farming type and economy), confirmed by a consideration of the historical development of land use, of drift geology, soils, vegetation, and known productivity.

There now remains the assessment of the relative quality of the land in each region so determined, and of its position in a national scheme.

A suggested solution

A detailed classification of land in Britain based on productivity and natural fertility would approximate very closely to a detailed classification of soils, at least within an area of comparable rainfall.[18] Undoubtedly an accurate soil survey is a major desideratum in this country, but, in its absence, only a broad classification of land is possible. Perhaps this has the advantages of simplicity and ready appreciation by all, and in the scheme suggested below ten major types of land have been distinguished, numbered 1 to 10. Types 1 to 4 inclusive are land of high agricultural value, types 5 to 7 land of intermediate quality, and types 8 to 10 land of low agricultural value. It is not true to say however that there is a steady gradation in utility and value from 1 to 10. First-class arable and first-class grassland may be equally important and valuable to the nation, but the two types of utilization require different physical conditions. Certain types are primarily suitable for crop production and have been distinguished by the prefix A (arable); others are naturally suited to pasture or meadow and have been distinguished by the symbol G (grassland). Some land may be equally suitable in either utilization (A–G); in other cases the symbols A and G may be used to separate varieties of otherwise similar land (*e.g.* downland suitable or unsuitable for ploughing). The poorer types of land under most economic conditions are normally under heathland, moorland, or rough pasture and have been given the symbol H (heathland).

The classification proposed is briefly thus:

A1 First Class Arable Land, capable of intensive cultivation.
A2 Good Arable Land, suitable for crop production.
G3 First Quality Grassland, fatting pastures and dairy pastures.
G4 Good Grassland.
G5 Downland, or Basic Grassland with certain areas (A5) suitable for arable cultivation.
A–G6 Medium Quality Farmland: which by reason of slope, climate, or soil cannot become first class but which is or can be productive whether under crops or grass.
G7 Poor Quality Heavy Land.
H8 Mountain or Rough Hill Pastures (Mountain Land).
H9 Lowland Heaths and Moors (Poor Quality Light Land).
H10 Saltings, Rough Marsh Pasture, Wastelands, etc.

A1 *First Class Arable Land, capable of intensive cultivation.* This is level or gently undulating land with deep, fertile, easily worked loam and silt soils, retentive of moisture and of fertilisers and often naturally rich in humus and mineral salts. It is developed especially on alluvium, brickearth, and other superficial deposits, but also on some fine-grained sandstones (especially if calcareous) and marls. Such land does not occupy more than about 5 per cent. of Britain; much of it was known to and appreciated by the medieval farmer and has been cropped for centuries. Such areas as the Fenland and the Lancashire "mosses" however have only been made available by careful drainage, and this is true of all areas of mild peat.

Such land is of course ideal for ordinary arable farming, but is also used and could be more extensively used for the intensive production of vegetables

and fruit. Unfortunately such well-drained, level land is eagerly seized both by industrialists for the modern horizontally laid out factory and by housing developers who find the minimum of expense in providing foundations, roads, and drainage. Huge tracts have been taken for such public utilities as reservoirs, and the loss to the nation as a whole of one of its most valuable natural assets is serious. The value of such land for purely agricultural uses though high is insufficient to protect it from acquisition for non-agricultural purposes, and it clearly needs some form of government control.

A2 *Good Arable Land.* The major stretches of good arable land, suitable for ordinary crop production, are found especially in eastern England or parts of eastern Scotland where climatic conditions—a rainfall under 30 inches and abundant summer sunshine—as well as soil and topography favour the growing and ripening of crops. The soils, according to which the farming varies (*e.g.* barley on light soils, wheat on heavier), vary from light to heavy but they are usually loams with a minimum depth of 9 or 10 inches. The soils belong to the Brown Forest Soils, drainage is free, and the water-table sufficiently low to prevent waterlogging.

On land in the climatically favoured east with these characters the physical factors have been sufficiently powerful to resist the influence of such economic factors as low corn prices and so arable cultivation has remained dominant. On the other hand much country not quite as good as that in East Anglia (*e.g.* on the limestone soils of the Cotswolds) has been laid down to grass: this is land which in times of national need as the present ought again to be brought under the plough almost entirely: not just an increase of some 20 per cent. Allowing for waterside meadows and patches of woodland, 80–90 per cent. of the total areas ought to be ploughed. In the period of the tithe survey (*c.* 1840) this was the approximate proportion under the plough, and the tithe maps afford a good guide to present potential use, and this is the land from which Britain must obtain the bulk of her home-produced farm crops for human consumption: wheat for bread, barley for malting, and sugar beet; as well as crops for sale off the farm as feedstuffs: feeding barley, oats, roots, and fodder.

In the wetter west of England some excellent land (*e.g.* in the plain of Hereford) is equally suitable under arable or grass, but owing to climatic conditions the ripening of grain is uncertain. Such land may be designated A–G2.

G3 *First Class Grassland.* Some of the finest grasslands of Britain have never been ploughed and are definitely unsuitable for arable cultivation. Such are the riverside meadows liable to periodic flooding, especially the irrigated "water-meadows" of southern England,[19] and level alluvial lands where the water-table is near the surface. On the other hand the famous fatting pastures of the midlands were once ploughed. Although the modern school of thought believes that practically all grassland benefits by periodic ploughing and reseeding,[20] the traditional English view is that rich old pasture should be improved by draining, watering, and top-dressing but never broken up.[21]

First-class mowing meadows will yield a ton of hay per acre; with modern methods of grass-drying they could be made much more productive; good

fatting pastures will fatten for the butcher one bullock per acre without any supplementary feeding stuffs; good dairy pastures are scarcely less valuable, and all are vital to the nation's livestock industry and need protection against non-agricultural use just as much as good arable land.

The good pastures of the midlands can yield, and have done so, heavy crops of corn, but the land is heavy and expensive to plough and seems to serve the national interests best as grassland. It must further be borne in mind that the hedged small fields of the grassy midland shire permit exact regulation of grazing and enable the farmer to overcome the evils both of under- and over-grazing; but the same fields are too small as units in an economic arable farm.

G4 *Good Grassland.* The major stretches of grassland in the clay vales and heavy-soiled lowlands do not reach the carrying capacity of the First Class Grasslands. They are not strictly fattening pastures, in that animals fattened on them require subsidiary feeding. A large proportion of such land has been ploughed and cropped in the past, when every farm or village had to be almost self-contained, and often yielded good crops; but the expense of ploughing such heavy land ("three- or four-horse land" from the number of horses needed to pull one plough) is considerable. Deep ploughing may bring cold, heavy clay to the surface and ruin the land. Much of this grassland cries out for improvement by tile- or mole-drainage, chalking or liming, and sometimes for ploughing and reseeding to grass; but, with surface water available and the field units being small, it is as grassland that it can best serve the national economy.

Both types G3 and G4 belong to the Neutral Grasslands of the ecologist[22]: G3 is dominated by, or has a proportion of, rye grass (*Lolium perenne*) and wild white clover (*Trifolium repens*), though in some cases the quality of pastures, may be simply the result of excellent vegetative growth of other grasses,[23] G4 is normally *Agrostis* pastures (with *Agrostis tenuis*, *Cynosurus*, *Holcus*, etc.). G4 is the General Purpose Grassland of Stapledon.[24]

A separate category might well be made for poor *Agrostis* pastures which ought to be improved and which cover so much of Britain. Rushes, thistles, and other rough herbage are generally a sure indication of land in need of drainage or better management.

G5 *Downland or Basic Grassland with certain areas* (A5) *suitable for arable cultivation.* The traditional sheep-pastures of the Chalk Downs and Limestone Pennines correspond closely to the basic grassland of the ecologist,[25] dominated by fescues (*Festuca ovina* and *F. rubra*). The soils are usually light and thin, though sometimes heavy through consisting of the clayey residue from which the limestone has been dissolved or leached away, in which case they may be poor in lime. Over large areas ploughing is impossible owing to the presence of hard limestone near the surface (Pennines), but the thin light-soiled chalk tracts form arable-sheep-barley land which has often been cropped when corn prices were high and then, unfortunately, abandoned to become a tangle of thistles and weeds. Cobbett [26] regretted this in 1822, and the same state of affairs was found on the same land in Hampshire in 1938.[27]

A–G6 *Medium Quality Farm Land.* Over huge areas of Britain, especially

in the western counties and associated with outcrops of the older rocks of Highland Britain, there are lands which by reason of slope, climate, and soil cannot become first class but which are productive of both crops and grass. The dominant soils are best described as immature; they vary in texture, colour, depth, and quality, but are usually marked by the presence of angular fragments of the shales, mudstones, slates, "killas," sandstones, gneisses, schists, or other rocks of the subsoil. Largely owing to the moderate or heavy rainfall (35–70 or more inches) the dominant type of farming is long-lay: ploughing and cropping for two or three years and then seeding to grass for anything from five to twenty-five years. With comparatively few exceptions all the fields of a farm are thus ploughed in turn, though only a fraction, perhaps one-sixth, of the farm is under arable cultivation at any one time. Conditions do not favour crop ripening, the produce of the arable land (largely oats, roots, and green fodder) is directed towards the feeding of live stock, whether dairy cattle, beef cattle, or sheep.

This is undoubtedly the best type of farming for the land, but capital is needed and constant care to maintain the standard of farming and to keep the land in good heart; too often the fields are allowed to "tumble to grass"—*i.e.* revert to grass without proper seeding; and the dominance of poor *Agrostis* pasture is evidence of the need of liming, manuring, drainage, and proper seeding. As a whole the grassland is acidic or siliceous grassland, dominated by bent-fescue, often marked by invasion with bracken, gorse, etc., and so grading to the Untended Pastures of Stapledon.

G7 *Poor Quality Heavy Land.* The physical conditions and soils in this type of land generally represent one stage worse than those of G4. Over large areas heavy intractable clays prevail, not only costly to drain and work but difficult also. The soils are usually deficient in one way or another: they tend to be sour and need constant expenditure on lime; in some cases peat has developed and partial stripping of the peat is a pre-requisite of improvement.

Some large tracts of such land are under deciduous woodland and have probably never been cultivated (*e.g.* Blean Woods of Kent, Ashtead and Bookham "Commons" of Surrey, all on London Clay) and might perhaps be more fully utilized for the production of oak and other hard woods. On the other hand much of this marginal land, generally poor grassland with reeds, rushes, bracken, brambles, and other rough herbage, ought to form part of the grazing lands of the country. But it needs large-scale control in drainage and management, and may be a fit subject to Government action since the expenditure involved, if justified on the ground of national needs, is beyond the power of the individual owner or farmer.

Patches of such land usually occur in areas of A–G6 where drainage is bad and the vegetation belongs to the group of acidic grassland—especially poor *Agrostis* with rushes.

In the drier parts of Britain are similar poor clayey lands (*e.g.* parts of Huntingdon) but where physiological drought may be a fault rather than excessive wet.

H8 *Mountain or Rough Hill Pastures.* Rough grazing, comprising a great variety of types of natural or semi-natural vegetation (especially moorland and heathland), covers two-thirds of Scotland, one-third of Wales, and large areas

of England. The bulk is on uplands of old rocks, especially above 1000 feet, and subject to a heavy rainfall and much hill mist. Large tracts of hill land were stripped of soil and loose rock by the glaciers of the Great Ice Age and outcrops of bare rock are frequent. This alone prevents the use of a plough in improvement. Elsewhere there are poor, stoney, immature soils, usually acid and leached (podsolic); in areas of impeded drainage acid peats are developed.

This sub-marginal land is the problem land of Britain. At present most of it is unenclosed and has a limited use as hill grazing for sheep and cattle, as sporting estates (grouse moors, deer forests, etc.), and elsewhere as gathering ground for urban water supplies. It ought to be made more productive. Probably a third is suitable for improvement as grazing by the processes of burning, disc ploughing, and seeding advocated by Sir George Stapledon [28]; another third is suitable for afforestation, leaving the remainder much as at present: an abundance of open space for public or private recreation (including national parks) and sport as well as for water supplies.

Vegetation permits a detailed classification with such types as *Nardus* pasture, *Molinia* moors, *Eriophorum* (cotton grass) moors, heather moors, bilberry moors, etc., and potential utilization is therefore made apparent.

H9 *Lowland Heaths and Moors* (*Poor Quality Light Land*). These are old "wastes" of the medieval and eighteenth-century farmer: they are the commons and heaths valued to-day as public open spaces. They are usually on very light sandy or gravelly podsolized soils, from the farmer's point of view too hungry (*i.e.* absorbing but not holding moisture, manures, etc.) to be economically suitable for cultivation except in certain circumstances. Cultivation has often been attempted in some areas, as in Breckland or the sandy coastlands of Suffolk, but as often abandoned leaving a trail of soil erosion and waste land.

It is true that modern science permits the use of pure sand to which can be added precisely the plant food needed by whatever crop is to be raised, and in the future light sands and silts may be ideal for such artificial cultivation; but in the present economic conditions of farming these lowland heaths and moors are probably better in non-agricultural usage. Where near populous centres they are ideal as open spaces; the heathy, quick-drying surface with occasional pine trees is appropriate. For housing the conditions of good drainage are healthy, though the householder must not expect an easy return from his vegetable patch; other areas are useful for military training. Large areas can be and have recently been used for softwood afforestation, and Breckland now includes the largest forest in the whole of Britain.

H10 *Saltings, Rough Marsh Pasture, Wastelands, etc.* Land which has been included in this lowest category is very varied in character, but in its present state is of limited agricultural use. Saltings and rough marsh pasture may afford some periodic grazing, but it must not be forgotten that properly reclaimed (as around the Wash) they afford land of category A1, elsewhere of G3. On the other hand shingle areas (*e.g.* Dungeness) must remain virtually useless. It so happens that considerable tracts border navigable tidal water and offer excellent sites for heavy industry—a use which is to be commended in any scheme of national planning.

To this land classification scheme, of which many important details have been omitted for the sake of brevity, some objections may be urged. Is it not possible so to improve the land in each category that the classification is no longer true? Such is the case, but the improvement will be mainly a process of stepping up rather than transfer from one type to a different one. The classification, based primarily on soil and physical characters, is fundamental and suggests the folly of indescriminate ploughing up without careful investigation of the suitability of the land. When the scheme was discussed with Mr. G. H. N. Pettit of the Cambridge Department of Agriculture he suggested an eight-fold scheme which would stress potential utilization more directly. His tentative suggestions can be combined with the above scheme thus:

Pettit	*Present Scheme*
1. First Class Agricultural Land:	
(*a*) Arable or suitable for arable ..	A1 and A2.
(*b*) Grass unsuitable for arable ..	G3 and some G4.
2. Second Class Agricultural Land:	
(*a*) Arable or suitable for arable ..	A5 (light), A6 (medium).
(*b*) Grass unsuitable for arable ..	G4, G5 (light), G6 (medium), G7 (heavy).
3. Rough Grazing Land:	
(*a*) Lowland	H9.
(*b*) Upland	H8.
4. Land Agriculturally Unused:	
(*a*) Usable	H10.
(*b*) Unusable	„

The correlation of the proposed scheme of land classification with rental and freehold values

Amongst the classical economists Ricardo long ago asserted that differences in rent arose from differences in the "original and indestructible qualities of the land." Present-day conditions in Britain show that there is a relationship between land productivity and rent, but it is not a direct and simple correlation, for the land which is capable of the greatest production is not necessarily the highest rented.

In the first place there is abundant scientific evidence to show that land when ploughed and cropped gives a greater return in food, however measured, than the same land under grass can give, whether the production is measured directly as pasture or hay or by the animals which it supports.[29] Accordingly, arable land or land suitable for arable farming ought to command higher rentals than grassland and arable farms than grassland farms of comparable size. Actually this is not the case: on the contrary a good grassland farm commands a higher rental than a comparable arable farm, the reason being that it is easier or surer to secure a reasonable return from milk and meat than from crops which frequently entail greater labour costs to produce and may be subject to intense foreign competition. To the tenant farmer rental is related not to the productivity of the soil but to the capacity of the farm to yield him a profitable return. There is thus an economic incentive to lay

arable land down to grass—a tendency very marked over the past decades—and so to render it less productive to the nation as a whole though more remunerative to the farmer.

In the second place the average British farmer is an independent individualist and is concerned primarily with maintaining the farmstead as a home for himself and family and a means of making sufficient money to keep them in reasonable comfort. This he can achieve either by farming intensively a few acres, for example a small holding with market-garden crops or poultry, or less intensively a larger area. A considerable proportion of the rent of the farm represents the value to the farmer of the farmstead as a home. The farmer is in the same position as the small shopkeeper who can and does manage adequately a small shop but has no use for and could not manage large premises. It is curious that the system so common in retail distributive trades of a limited liability company with a number of shops each in charge of a manager has no parallel in British agriculture: the company owning a number of farms each in charge of a competent manager is, unfortunately, very rare. Thus rentals, calculated per acre, are highest for small holdings and decrease steadily as the holdings increase in size. A farm of 10 acres may be worth 60*s*. an acre, one of 500 acres on exactly the same land only 15*s*. Nearly half of all the agricultural holdings in Britain are between 5 and 50 acres in extent.

It is a common practice for an owner or tenant of a farm to rent additional land, either to increase the size of an uneconomic holding or to secure land of a different character for some specific purpose, *e.g.* additional summer grazing. It might be thought that the rental of such land, since the value of a farmstead or farm buildings is not concerned, would be a truer measure of its productive capacity than the rental of whole farms. Actually such rentals are often artificially high, as when accommodation land is required near a market; or abnormally low, as when the owner of the additional land has no means of farming it himself.

Bearing these limitations in mind, it is possible to construct maps showing average rentals of farm land and such maps do show a general correspondence with land productivity. In the course of preparing a Report on Shropshire, Mr. E. J. Howell has constructed such a map for the county. There the rental values of land range from less than 5*s*. per acre for hill grazing in Clun Forest and the Longmynd to 40*s*. in the rich Corvedale.[30] Mr. Howell has shown his figures as capital values.

Britain is almost unique in the high proportion of tenant farmers. In many countries the tenant is the shiftless man who has not the ability to acquire and work a farm of his own and who rents one to get what he can from it for a few years. Consequently Ellsworth Huntington, writing of the United States, tends to ignore rentals and states that the "best available measure of whether the farmland in a given region is good or poor appears to be its selling price."[31] In Britain, on the other hand, the prices at which land changes hands may fluctuate between the widest limits even in the same area and these prices form but a poor guide to the measurement of intrinsic agricultural worth. Actually a common form of freehold valuation is to take twenty to twenty-five times the net annual rental value.[32] A large proportion

of the sales of farms and farmland are forced sales, occasioned by the death of an owner and the need for immediate funds for payment of death duties. Consequently the price paid depends not only on the usual factors of demand, for the farmhouse as much as for the farmland, but on many others. The question of ingoings necessary to bring buildings, farm roads, and especially fences to a proper state of repair is especially important and in the case of a neglected farm such ingoings may be so heavy that the farm may, in some cases, be expensive as a gift. When a farmer rents a farm he rents it as agricultural land from which to obtain a living; on the other hand a purchaser is concerned also with development values. In the south of England downland worth £20 an acre as agricultural land may command £1000 an acre as "choice building sites" if the usual services are available. It is almost impossible to separate these development values since their assessment depends so largely on the individual judgment of the purchaser.

Some practical applications

It may be thought that the main proposals suggested above, the delineation of small land-use or agricultural regions and the assessment of their actual and potential productivity, are interesting academic exercises but of doubtful practical value; that the extension of production needed at the moment is essentially a problem to be solved locally by the practical farmer; and that the post-war planning of agriculture must be on a national basis and handled by the economist. These contentions deserve consideration. Regarding the first, the local farmer knows and makes allowances for his own local conditions and the Ministry of Agriculture has wisely delegated much of the wartime control to the County War Agricultural Executive Committees so that regionalism is recognized. With regard to the second point it will be fatal if the agricultural economists ignore the significant regional factors so clearly recognized by pioneer agriculturalists such as William Marshall.[33] As the writer has stressed elsewhere,[34] the natural factors are more important to-day than ever before: in the past the village community and the national community had to be largely self sufficient; with the increase of transport and communication the resources of the world are available and each region must concentrate on the production of those commodities for which it is best fitted by natural endowments; in other words the optimum form of land use for each must be found.[35]

Thus the determination of these regions and the measure of their potential production is a keystone of present national needs. Under the present Farm Survey farms are being classed as A (good), B (moderate), and C (bad). But this must be judged in relation to the region; a C farm on A-land may be producing far more than an A farm on C-land and C farms in Cardigan and Cambridge may be, and are, very different. There is no doubt that any farm survey will reveal the large areas of neglected farm land, some needing but a more active farmer, but many needing more extensive and expensive attention in drainage and improvement. Not only is a national plan needed in this connection but any plan has a direct connection with needs of man power, and the Farm Survey becomes linked with the Man Power Survey. Now, most certainly, is the time for an adequate stocktaking of national resources of which the land forms such an important part.

REFERENCES AND NOTES

[1] Land Utilisation Survey 1-inch maps. One hundred and five sheets have been published (equivalent to one hundred and ten O.S. sheets) covering the Midlands, south and east of England, south Wales, central Scotland, and representative areas elsewhere.

[2] In the County Reports of the Land Utilisation Survey, published under the title of 'The land of Britain' and to be completed in ninety-two parts. Issued include Ayr, Moray, and Nairn, Sutherland, Zetland, and Orkney; Glamorgan, Pembroke, Anglesey, and Radnor; Berkshire, London, Hampshire, Somerset, Dorset, Rutland, Ely, Holland, Norfolk, Suffolk, Derby, Wiltshire, Hereford, Lancashire, and Cheshire.

[3] Pioneer work of this type was carried out by H. C. K. Henderson in Sussex and Derby.

[4] Especially the official Agricultural Statistics from 1866 onwards.

[5] Notably the County Reports prepared for the Board of Agriculture from 1795 onwards and from such general accounts as those contained in Cobbett's 'Rural rides' and Defoe's 'Tour.'

[6] Especially in the Reports on London, Norfolk, Derby, Hertford, and Hampshire.

[7] R. G. Stapledon, 'The land now and to-morrow' (London, 1935), and other works.

[8] *Vide inter alia* G. W. Robinson, 'Soils' (1936), and 'Mother earth' (1937) (London, Murby).

[9] For examples see 'The land of Britain,' Part 69 (Holland) and Part 89 (Hampshire).

[10] F. E. Clements, 'Plant succession' and later works (Washington).

[11] A. G. Tansley, 'The British Islands and their vegetation,' Cambridge, 1939.

[12] William Davies in R. G. Stapledon (ed.) 'A survey of the agricultural and waste lands of Wales,' London, 1936.

[13] See especially the series of papers contributed to the International Geographical Congress at Amsterdam, 1938 (*Contes Rendus, Cong. Int. Géog.*), especially by W. Van Royen, E. Huntington, A. Pecsi, and I. Batakliev.

[14] An interesting discussion of the problems involved will be found in an unpublished thesis by J. B. Goodson, entitled 'The appraisal of agricultural productivity,' which may be consulted in the University of London Library.

[15] M. G. Kendall, "The geographical distribution of crop productivity in England," *J. Royal Stat. Soc.*, January 1939.

[16] There are of course many other proposed methods of measuring production. Dr. Ellsworth Huntington's index of production (measured by value) is

$$V = \Sigma PM / \Sigma A$$

where V is value of production per acre of cultivated land
P total production in weight
M the money index of the particular crop
A the acreage of all crops included.

(*Annals Amer. Acad. Soc. Sci.*, 1938, 73–92). The author only applied these to countries as a whole.

The conversion of all produce into calories per acre or into starch equivalent per acre, are other bases of calculation.

[17] O. Jonasson, "Agricultural regions of Europe," *Econ. Geog.* I, 1925.

[18] A heavy clay almost useless with a heavy rainfall may prove quite a useful arable soil with a lower rainfall; similarly light loam or sand of little use with a low rainfall may be excellent market-garden soil with more moisture.

[19] H. P. Moon and F. H. W. Green, "Water-meadows in Southern England," 'The land of Britain,' Part 89 (Hampshire), Appendix II.

[20] R. G. Stapledon, 'The plough-up policy and ley farming,' London, 1939.

[21] Pitt, 'General view of the agriculture of Leicestershire' (1808), p. 157.

[22] A. G. Tansley, 'The British Islands and their vegetation' (1939).

[23] A. G. Tansley, in Moon and Green, *op. cit.*

[24] R. G. Stapledon, 1925.

[25] A. G. Tansley, *op. cit.* (1939).

[26] W. Cobbett, 'Rural rides,' Everyman Edition, vol. I, p. 114.

[27] F. H. W. Green, 'The land of Britain,' Part 89 (Hampshire).

[28] R. G. Stapledon, 'The hill lands of Britain; development or decay?' London, 1937.

[29] H. J. Vaughan, "The economics of production on grass and arable farms," *J. Roy. Agri. Soc.*, 185 (1924).

[30] In parts of Britain rentals may be as low as 6*d.* an acre. J. Mathieson (*Scott. Geog. Mag.*, 1938, 257) has stated that sheep farmers willing to pay 9*d.* per acre in the Scottish Highlands were outbid by bids of 1*s.* per acre for the same land as deer forests.

[31] Ellsworth Huntington, "The handicap of poor land," *Econ. Geog.* 2 (1926) 335. See also Supp. Report Land Planning Committee, U.S.A., 1935, with map of average land values. In Germany land values are used for taxation assessment and there is a definite correlation with productive capacity.

[32] The problems involved were discussed with Mr. W. J. Fleet to whom sincere thanks are due.

[33] In his 'Authentic register of the rural economy of the west of England' (1796), Marshall wrote "an *agricultural district* is discriminated by a uniformity or similarity of practice; whether it be characterized by grazing, sheep farming, arable management, or mixed cultivation; or by the production of some particular article such as dairy produce, fruit, liquor, etc., etc.," and implied the special consideration which each accordingly needed.

[34] "Planning the Land of Britain,"*Scott. Jour. Agri.*, xxi, 1938, 1–10.

[35] This point of view is by no means appreciated by all economists. Thus Lord Astor and Mr. Murray ('Land and life,' 1932, p. 24) contend that agricultural land "can no longer be regarded as a gift of nature—it is the product of so much expenditure of labour and capital." On the other hand A. W. M. Kitchen (*Econ. J.*, 44, 657–75) has shown a marked correlation between family income, value of output, and soil regions, though again the correlation is not a direct one.

DISCUSSION

Before the paper the CHAIRMAN (Mr. LEONARD BROOKS) said: This afternoon we are to listen to a paper by Dr. Dudley Stamp, the title of which is "The Productivity, Fertility, and Classification of Land in Britain." We cannot think of such a subject in connection with the name of Dr. Stamp without also thinking of the Land Utilisation Survey of which he is the Director. That Survey is probably one of the biggest pieces of research on a large scale carried out in this country for many years past, and it must be of very great value at the present time to such bodies as the Ministry of Agriculture. I am, as some of you know, chiefly concerned with secondary schools, and I know what great value that Survey and the map it produced have been in the teaching of geography in our schools. Dr. Stamp is a member of the Council of the Society and this is not by

any means the first time he has addressed one of our meetings, so he really needs no introduction. I ask him now to read his paper.

Dr. Stamp then read the paper printed above, and a discussion followed.

The CHAIRMAN: I now call upon my old friend, as I would like to call him Sir John Russell, to speak.

Sir JOHN RUSSELL: We shall all congratulate Dr. Dudley Stamp on the carrying out, under difficult circumstances, of the Land Utilisation Survey which represents the first effort made in our time to give a coherent account of the value of the land in Great Britain. Hitherto it has been easier to get information about agricultural use of the land at the end of the eighteenth century than at the end of the nineteenth; surveys had been made by the first Board of Agriculture but not by their successors. The new maps constitute a good starting-point for further work, because one hopes that the change from arable land to grass has now reached its limit and that from now on there may be some reconversion of grass to arable.

The various soil surveys made in recent years might have given the basis for soil classification in this country, but they were linked up with the advisory agricultural service, which is on a regional basis, and so they themselves were regional and not national as was the Geological Survey. In consequence, although there was a good deal of comparability about these different surveys, there was also much disparity both in method and in value. In a recent effort to make a soil acidity map of the country it was found that the local maps could not be pieced together, because different surveyors had used different methods and their results were not strictly comparable. It was highly unfortunate, for an enormous mass of data had been collected which might have been of more value than it has, but one hopes to get ultimately a soil map of Great Britain.

But a soil map will not link up quite closely with Dr. Stamp's map because soil productivity is an extremely complex property, involving all the qualities both of soil and of climate that are concerned in the growth of plants. Soil and climate are equally important: a soil which under a rainfall of 20 inches is unproductive may, under a rainfall of 40 inches, be quite good.

Dr. Stamp's classification can be both criticized and defended; any system dealing with so complex a subject as soil productivity is necessarily somewhat conventional and empirical. I should not feel disposed to criticize it, provided it is quite clearly understood, as Dr. Stamp pointed out, that the numbers A1, G3, etc., do not necessarily convey all that is meant. A1, for instance, although it stands above G_3, is not necessarily better than G_3.

One could fairly easily group the soils of Great Britain into three groups: good, bad, and intermediate. For the finer grouping necessary for Dr. Stamp's purpose, we are faced with the difficulty that the best grassland and the arable land cannot be directly compared. They are equally good and important. The amount of food obtained from arable land is not necessarily greater than that obtained from grassland. It is different and more directly useful to human beings; but the actual quantity of protein equivalent produced per acre may be less. If one wished to represent the outcome schematically it would perhaps be best to do so by means of an X, with two horns at the top, two at the bottom, and a meeting point intervening. The good arable land and the good grassland cannot be equated but they can be put at the top of the two horns. Then there is a vast area of intermediate land which may be either grass or arable and which shifts from one to the other according to economic conditions. The poor lands of the country, which form the two bottom horns of the X, can be grouped according to their water supply; some is poor because it is too dry; this includes

the dry downland and the heath, some of which can be afforested with softwoods. The land which is too wet includes the heavy land which merges into woodland (hardwood) or moorland according to its altitude.

The amount of plant food in the soil is not a good basis for classification and is in any case easily altered by use of fertilizers and manures. Still less importance attaches in my view to calculations of supposed maximum yields. These calculations start from a hypothesis which holds only approximately, and they involve continuation of curves by a process of extrapolation, which is always dangerous. However, we shall await with interest the results of Mr. Kendall's efforts at the Ministry of Agriculture to assess the value of soils according to weight of crop. If that could be done on the basis of groups of parishes instead of on a county basis one could expect even more useful results.

The divisions, then, are not to be regarded as fixed because science is continuously developing and land which to-day is in category 2 may to-morrow be pushed into category 1. Further we do not yet know the limit of yields. At Rothamsted we have been growing wheat for nearly one hundred years under similar conditions, and thought that we had sufficient data to justify an estimate of our ceiling yield in a particular yield. But this year our yield soured up beyond the ceiling, and we still do not know where the limit lies.

Mr. M. G. KENDALL (Ministry of Agriculture): I should like to associate myself with what Sir John Russell said with regard to the value of Dr. Dudley Stamp's paper, and in particular to stress the importance of regional studies. It is sometimes an embarrassment to us in the Ministry of Agriculture that our returns are collected on a county basis and are by no means related to the natural regional distribution of agricultural conditions. It seems to me that the programme we have to contemplate is threefold. First, we have to ascertain where the regions are and delimit them; secondly, we have to arrange our agricultural statistics on the basis of the natural type of farming region; and thirdly, having obtained information on that basis, we have to proceed to research on it. As to the first category, Dr. Stamp has referred to the type of farming map which we at the Ministry of Agriculture drew up before the outbreak of war. I am glad to be able to say that arrangements have now been made for that map and the accompanying text to be published by the Land Utilisation Survey, on behalf of the Ministry of Agriculture, so that it should appear in the course of the coming year.

Having determined the natural type of farming regions, we can proceed to the allocation of the agricultural statistics; but that, I am afraid, will have to wait until after the war. Yet even there the prospects are hopeful because we are doing our best to get the agricultural analysis of the census put on to a mechanized basis. If we succeed in so doing, classification should be a comparatively simple matter and we should be able to provide the necessary information. The value of the research so based will be immense. Dr. Stamp has referred to some of the work I did on the productivity of the soil of the country. As he said, that work was rather in the nature of a trial of method than an actual production of useful results, one of the reasons being that the units on which I had to work were counties and not natural types of farming region. If we can work on the basis of the statistics we acquire for those regions, I think we shall be able to get a very close measure of the productivity of the particular area. Dr. Stamp referred also to another defect in the method I tried, namely the exclusion of grassland, and I thoroughly agree with him that some method must be found to bring grassland into the calculation.

How we are to measure yields of pasture and grass I really do not know. I tried to do it by getting some experimental data from grass driers, but they are

few and the yields vary so much that I do not think it of a great deal of use. It is possible to correlate grass yield with the yields of hay, but even that is not entirely satisfactory because there may be a dry period in the early summer and a harvest of a light crop of hay, followed by plentiful rain and a big aftermath. Some way, however imperfect, must be found. If we could bring in the grass area on a weighted basis we should get close to the real measure of agricultural productivity.

That seems to me a fair example of the sort of programme of research we have to contemplate when the regional figures are available; but it is one thing to agree that there should be a regional classification of farming and another to agree on a basis for that classification. Dr. Stamp, thinking primarily as a geographer, has suggested a classification largely in geophysical terms. Sir John Russell, speaking, I imagine, from a pedological point of view, is thinking largely in terms of soil. We at the Ministry of Agriculture tend to think of it largely as an economic problem. To the geographer or the pedologist an acre of arable land is simply an acre of land under the plough; to the economist it makes all the difference whether it is growing crops that are fed to livestock or crops that can be fed direct to human beings. The basis of the organization of farming is complicated by such matters and I would stress the importance, when classifying the farming of the country, of taking into account the economic factor. I know Dr. Stamp is imbued with the importance of that aspect, and when we leave technicalities for actual practice there is, I believe, little difference between us.

Perhaps in conclusion I might add a few cautious words with regard to the ploughing-up campaign to which Dr. Stamp referred. There are one or two points which might usefully be recognized in that connection. It is true, as Dr. Stamp said, that the important part is the ploughing up of grass. But it is also possible to operate, and we are operating, by increasing the productivity of the existing arable land. If we could increase the productivity of the existing arable land by 10 per cent. we should obtain the same result as by ploughing up at least 1,000,000 acres of grass. The possibilities in this direction however are limited by the fact that many of the fertilizers used in this country have to be obtained, if at all, from overseas. The real importance of the home-food production campaign at the moment is in the ploughing-up campaign, and there we are going ahead as fast as we can. The importance of that campaign is not merely that it increases the supply of food but that it is a national advantage to have as much of the land as possible under arable production, and to grow crops of a "dual-purpose" type which can be used to maintain the livestock of the country but, were it ever necessary, could be diverted at any stage during the course of the year into the human stomach. The gain in starchy equivalent of feed in going from grass to wheat and potatoes is quite considerable, but there is the equal importance that, while it is not possible to feed grass to human beings, it is possible to feed them oats, roots, and potatoes. The flexibility of the ploughing-up campaign is a feature of agricultural production in war-time which has not been generally appreciated.

The CHAIRMAN: The hour is getting late and it seems best to bring the proceedings on this very complex subject to a close. I should like in your name to thank Dr. Stamp very much indeed for his paper and for the discussion that he has provoked.

Dr. DUDLEY STAMP: I agree with Sir John Russell that the scheme put forward is conventional and empirical. I hope I have stressed sufficiently that my classification A1 to H10 is not in order of merit and that not only is that fact recognized, but also the flexibility in interchange between the classes. Agri-

culture is dynamic, never static. I am glad to have Sir John's confirmation as to the wild estimates of hypothetical yields. Their value and validity have always puzzled me. With his authority I shall in future be able to speak with greater assurance on that point. Mr. Kendall has on many previous occasions given me cause for thought, and we should all congratulate ourselves on having such a live scientist in the Ministry of Agriculture.

A number of written contributions were also submitted.

Mr. G. E. PEPLER: In the past those responsible for the planning of town and country have been blamed because they have failed to preserve good agricultural land for agriculture and have allowed it to be invaded by bricks and mortar. In point of fact, they were not blameworthy, firstly because authoritative information was not available as to what was good agricultural land, and secondly because if building value exceeded agricultural value reservation for agriculture would have laid the planning authority open to a claim for compensation. There is possibly a third point, namely that land used for housing at a reasonably open density of building may produce quite a lot of food in the cottage gardens. This was one of the factors that originally determined twelve houses per acre as a reasonable maximum density for cottages, and I should be grateful for Dr. Stamp's opinion on the point.

A most interesting feature of his paper is that it brings out true values of land in terms of productivity and, if the land of the country could be surveyed and classified as Dr. Stamp suggests, it would provide invaluable information for the town and country planner and should be a basic factor in any national plan.

Sir GEORGE STAPLEDON: Dr. Dudley Stamp's paper is very opportune, and I have read it with deep interest and appreciation. Always essential, it is now, under the stress of war, doubly important that our agricultural policy should be based upon a just assessment of the condition of the lands of this country. Dr. Stamp's paper, being a geographical review of the condition of the agricultural lands of the country, serves to stress the importance of accurate surveys, which no man is more entitled to do than Dr. Stamp. Because of the results of the survey of the grasslands of England recently undertaken by my Department under the able guidance of my colleague Mr. William Davies, I am able to endorse whole-heartedly the main thesis and conclusions of the paper. On a few points however I find myself in disagreement. Dr. Stamp is perhaps a little optimistic in his belief that because "of a general level of intelligence . . . amongst the farming community, crop yields do reflect the fertility or productivity of the land." Would indeed that this were so: in truth, whether we compare one wide district or one farm with another, the fact is entirely otherwise. For example, the high productivity of Tweedside farms compared, for instance, with the disappointing productivity of those in large areas of Warwickshire is much more due to a difference in human competence and enterprise than to the influences of soil and climate; and everywhere one meets examples no less true and no less striking. The range of efficiency between the best and worst farmers in this country is greater than the most extreme biological, chemical, or physical differences exhibited by even our wide range of soils and vegetable types. Thus, in general, Dr. Stamp hardly sufficiently emphasizes the influence of management upon the productivity of the soil, nor the fact that modern implements and modern fertilizers make it much more easy to bridge the gaps between the worst and best types of land than is generally supposed. This latter fact was brought into strong relief by our grassland survey to which I have referred, and most certainly "it does not follow that the present-day utilization of any given region is the *optimum* utilization."

The sad truth is that in our agricultural practice we only attain to the *optimum* utilization on a relatively small proportion of our lands, while we must never forget that our standards of what constitutes "*optimum*" must be subjected to constant review, in sympathy with the onward march alike of science, of technical efficiency, and of enterprise.

Mr. A. MACKINTOSH: I agree with Dr. Stamp that the key to sound agriculture in Britain is the principle of optimum land use. Any price or other agricultural policy which gives rise to land values at variance with land-use values will prevent, not expedite, the real maximization of production. In war-time some diversion of land from the production of commodities to which it is best suited to the production of others to which it is less well suited is rendered inevitable by restrictions upon our ability to import foodstuffs, feeding-stuffs, fertilizers, and other agricultural commodities according to choice. Nevertheless, the present situation makes it possible for the State, with the help of data such as that provided by the Land Utilisation Survey, to give effect to a planned agricultural policy capable both of responding most fully to the country's immediate demands and of developing after the war into a system based upon optimum land use. It is clear that this can be achieved only by means of direct action by the State, particularly in the organization of man power. A body such as the "Lands Commission" proposed by Sir George Stapledon, employing mobile gangs of workers in the scientific reclamation and improvement of land, is a present necessity for the satisfactory development of British agriculture.

Mr. J. B. GOODSON: A few years ago the distinction between fertility and productivity, and the problems to be solved before the productivity of the land could be measured, were very little appreciated, and it is still important that the difficulties of a classification upon this basis should not be underestimated. The task is no mere academic exercise, but, as Dr. Stamp has shown, a necessary preliminary to wise planning. For this reason we should be grateful that the Director of the Land Utilisation Survey and the Senior Statistician of the Ministry of Agriculture are both actively interested in the question.

Sir John Russell has uttered a warning against attempting to compare things which are not comparable, and Dr. Stamp has rightly kept separate in his classification the best arable land and the first quality pastures. Mr. Kendall's ranking coefficient avoids the necessity of choosing a common denominator in terms of which to compare the production of diverse regions, but it may well be that the valuable figures he has calculated would lose something in definiteness if production from grassland were incorporated in them. When one region is assessed as more productive than another it should be possible to specify *of what* it is more productive. Unless this can be done the concept of productivity becomes abstract and nebulous.

With regard to the position of mountainous moorland counties such as Westmorland in Kendall's ranking, it should be borne in mind that the moorland parts of the county have played no part at all in determining the coefficient which is based upon the area under the ten chosen crops.

Professor G. W. ROBINSON: The statement that Highland Britain has an agriculturally negative character requires modification. This may be true of the Scottish Highlands, but there are considerable areas in Wales that are by no means sub-marginal. Owing to neglect of liming and drainage they are not as productive as they should be but, where these are attended to, very high yields are obtained. Regarding present use in general, I think Dr. Stamp has given insufficient weight to casual and personal factors. With similar physical characteristics considerable variation in use is possible; apart from strictly economic causes, a few good farmers may by their example grade up the agri-

culture of a district. In North Wales there is probably an excellent field for horticulture: what is lacking is the men to carry it through, and the development achieved is mainly the work of immigrants. I would also qualify the statement that the traditional ploughlands are usually the best ploughlands. Alternate husbandry by Sir George Stapledon's methods can and should be extended in most grassland areas.

The proposed classification appears to cover all types of land, but the definitions present great difficulties. It is hard to decide on the suitability of a given site for arable, grassland, etc. A revolution or even an improvement in agricultural methods might entirely disturb the classification of sites. Perhaps it would be better to classify according to actual use, distinguishing a limited number of classes, and to work out a scheme of productivity ratings. Assuming that a farm is in a certain class, one must first find a numerical expression for maximum production in this class, and then express the actual productivity of the farm as a percentage of this figure, calculated either on production or on estimated production under the best management.

Professor E. G. R. TAYLOR: Dr. Stamp has done a great service to clear thinking by his presentation of a straightforward scheme of land classification. There is too rarely any attempt to-day to distinguish between actual production and potential production or productivity, and as a result, much of the published work on the subject of indexes of productivity is of little value. For immediate purposes we need to be told quickly what a certain piece of land does produce, and what it has produced in the past. Failing this information, we can form an estimate by referring to land of similar type. Dr. Stamp has noted the value of the historical approach, which is one in which I am particularly interested, since a quite numerous band of Birkbeck College students, under the leadership of Dr. H. C K. Henderson, were recently working out the details of past land use in the Home Counties. During the last war, as is well known, much pasture land was broken up, and the local agricultural authorities had complete records of what was done. Incredible as it may seem, these records were subsequently destroyed, save in rare instances. It may be hoped that the proved usefulness of Land Utilization Survey will ensure the preservation of details of the present ploughing-up campaign.

Note by the Author: While I still assert that the best agricultural land *must* be protected from industrial development, Mr. Pepler has raised an interesting point. If the "dig for victory" campaign were to make the majority of gardens productive of fruit and vegetables under intensive horticultural conditions, the land covered by a housing estate with not more than twelve houses to the acre would probably be as productive as a whole as it would have been under ordinary farming conditions. No scientific proof is needed of the superior qualities of garden-produced vegetables.

Sir George Stapledon and Professor Robinson emphasize the human factor. I think our points of view are really the same. I had in mind "potential" intelligence of farmers and meant that the big men, who farm both in Aberdeen and Norfolk for example, were already helping to eliminate local differences in human efficiency. My land-use regions, based primarily on unalterable physical factors such as climate, relief, and *major* soil characteristics (*e.g.* depth, ploughability, texture in the broad sense including stoney or stoneless character) are wider than the divisions on a grassland map which reflect immediate human influence.

In using the phrase "optimum land use" I had in mind that the optimum must (*a*) be related to all human needs, not merely production; and (*b*) in any given region would vary with prevailing economic conditions.

THE ADAMS VALLEY AND GLACIERS, SOUTHERN ALPS OF NEW ZEALAND

J. D. PASCOE

THE Main Divide of the Southern Alps between Canterbury and Westland is a chain of glaciated peaks linked with curious passes. The subranges are equally intricate and the whole forms a fascinating wilderness for the traveller whether he is botanist, deerstalker, prospector, geologist, or mountaineer. The story of the exploration of the Southern Alps is long and eventful, and even in 1938 was not complete. Some men of purely alpine experience made the mistake of assuming that all the accessible valleys had been trodden. Thus in 1882 in the *N.Z. Alpine Journal*, No. 22 (p. 127), W. G. McClymont wrote, "Only the Murchison remained to be explored" at the date when sheepmen entered that valley. Actually for years later in many parts of the Southern Alps, particularly in Westland, there were quite unexplored valleys, and some are still unmapped.

In 'Mountaineering' (The Londsale Library), at p. 281, H. E. L. Porter criticizes the absence of reliable maps of the New Zealand high country. His criticism is justified. But the truth is that the Lands and Survey Department can cater only for the tourists in the Mount Cook region, the prospectors and cattlemen in the lower reaches of Westland rivers, and the sheepmen in the foothills. Where economic conditions do not require accurate surveys, the Government does not grant its officers money for what it considers would be to no purpose. So it is left for amateur climbers to improve the knowledge of access to their own terrain. This article describes two expeditions into the unknown watershed of the Perth–Poerua–Adams ranges in Westland carried out with fellow-members of the Canterbury Mountaineering Club. Any blanks in the maps which our parties aimed to fill have been attacked only in brief periods, limited to annual leave, and with the elementary aids of prismatic compass, aneroids, and panoramas made with commonplace cameras. Appetite for mountaineering can be whetted with the taste of reconnaissance work, mild in technique, but welcome to the Lands and Survey Department.

The Perth river flows from terrace icefields north of the Rangitata Divide and is a branch of the Wataroa; the Adams river, from glaciers west of Mount Tyndall, feeds the Big Wanganui; and the Poerua river comes from a valley glacier west of the Wilberg Range.

In December 1934, J. G. Malcolmson, A. P. Thomson, G. D. T. Hall, and I left Christchurch for the Rangitata headwaters. At the Erewhon homestead we unloaded our car and set out past the picturesque Jumped Up Downs to the Clyde Branch of the river. At MacRae's hut we checked over stores and equipment and discussed plans and maps far into the evening. The following day gave good valley travelling but the river was flooded and had to be crossed on a rope. The back-country ranges are not in themselves fiercely Alpine but there are the quiet obstacles of floods, untracked bush, and gorges. The semi-exploring mountaineer must carry his pack without horses or porters, exist without huts and chalets, and be adept in river crossing, bushcraft, and camp cooking.

On Christmas Eve we camped at 4000 feet on moraine boulders of the Wee Macgregor Glacier, our carols interrupted by an ice avalanche from Mount Tyndall. At noon we crossed the Perth Col, 2500 feet above and were surprised at the extent of the snowfields. Although the Adams mountains do not rise far above 8000 feet, the intense precipitation of the nor'west storms sheathes the ranges with interesting glaciers and icefalls. The 65-lb. swags caused a slight difficulty on the steep Perth *névé* on the Westland side of the Divide. From the lip of an ice slope a tin pannikin was thrown to test the glacier floor below. As it showed up in the sunlight the swags went next down the steep 500-foot slide without damage. Without their weight the steep slope was easy. The lower ice of the Perth glacier was uneventful, and late in the afternoon we passed the terminal face to camp in a flat with grass and buttercups.

Next day, December 26, to find out the lie of the country, we forded the Perth river and climbed up steep rock and snow to a terraced ice plateau many miles long, the key to the Perth–Adams ice-shed. This Garden of Eden with its outlet icefalls Eve, Cain, Abel, and The Serpent were in contrast with the sheer stripped rock cliffs of the Rangitata Divide to the south. In stormy weather we headed for a broad snow saddle now known as Angel Col, and from this vantage point we noted that a broken icefall gave promise of access to the unknown Adams valley far below. A chamois galloped across a steep snow slope. Rain set in, and we retreated down a rock ridge, Eve's rib, to the Perth glacier, and thence to camp.

After two wet days December 29 was fine till noon. An attempt at the Great Unknown peak was abandoned when 500 feet from the summit, but we trailed back to camp with good information about the Adverse valley and access to the Poerua valley by a cunningly cleft col which may be passable to a party equipped for ice work.

Three wet days followed and the January bad weather had apparently come to stay. With a long journey ahead we set down the Perth valley for habitation on the West Coast. The river was in flood. Progress down-valley was a succession of climbs over boulders, in sub-alpine scrub. After two days we arrived at the Scone tributary: it was not wide, but well over a man's depth. Malcolmson led, as in all places. He gained a high boulder, roped, and made a racing dive across the icy torrent to the far bank. In turn we were pulled across on the rope. Alpine rope has various uses in corners of the Southern Alps. The waterproof packs were reasonably dry. Three days' delightful travelling took us to the settlement of Wataroa in South Westland. With the trip finished we had gained no summits but had definite information to lead us to the Adams valley another time. At the Hokitika Survey Office I spent time on mapping with the help of B. Andrews.

In December 1935 H. M. Sweney, A. F. Pearson, and H. McDowall and I tramped up the familiar Clyde branch of the Rangitata river which was in unusually high flood. On December 27 we crossed the Perth Col, whence three of us made a second ascent of Baker Peak, 7400 feet, an easy walk. Swagging a new route across the Garden of Eden plateau we went over the Angel Col, thence to a high camp on an outcrop of rock at 5500 feet.

Phot. Pearson

1. Clyde Valley from Armada Bluff

Reproduced by permission of Messrs. George Allen and Unwin

3. Perth Col and Mount Outram from Eden ice plateau

Phot. Pearson

2. Bluff and river work: upper Clyde Valley

4. Terminal face of Perth Glacier

Next day we prowled in rough weather up the Arethusa *névé* to the Iceland Col, 7120 feet, taking what observations we could, between breaks in stormy mist, of the untraversed Poerua gorges and valley. From Iceland Col we made first ascents of Mount Kensington, 8150 feet, one of the highest peaks in the region, an ice climb, and of Mount Hulka, 7721 feet, on rock.

On December 29 6 inches of rain fell, but the camp was snug. A first ascent of Guardian Peak, 7500 feet, above Angel Col, was made in clear weather which helped our panoramic observations. At 2 p.m. we returned to the full swags and worked down the upper Adams icefall. The lower icefall is confined between two rock walls only a few chains apart. Progress in the broken ice was awkward so we slithered to a rock shelf under a waterfall, but further water-worn rock led to humiliation. We reached the Adams river flats at twilight and cooked far into the night. The flats were wide and carpeted with flowers and sub-alpine scrub.

On New Year's Eve, Sweney and McDowall followed the Adams river flats to the Eblis gorge. Pearson and I took observations of the terminal face of the Adams glacier. Mistrusting the difficulties of Eblis gorge, Pearson and I spent New Year's morning in gaining the crest of Speculation Hill, 5300 feet, from the Boulderpool stream and ridge. We were satisfied that a route could be made with swags. On January 2 we all reached the top of Speculation Hill in mist which turned to rain. Regretfully we abandoned plans for a high-level route over the tops, and dropped down a creek bed lined with schist, the Hot Springs feeder of the Wanganui river. At 3000 feet the strata changed and the creek led to a gorge where we had to swim two pools, 11 feet deep and up to 30 yards long, keeping afloat on the buoyant swags. In the evening we slunk from the rain to a cave in the bush formed by a dry boulder, and looked ruefully at the gorge ahead.

The next two days were spent in worming a way along the bush sides of the deep canyon. For thirty-six hours water was not obtainable, a paradox in a rain forest; we lived on dry oatmeal rolled in butter. Sweney's fine leading in the bush took us out of our trap, and working by compass bearing we climbed a spur, later descending to the Wanganui valley, where hot sulphur springs and mosquitoes revived us; and on January 5 we reached the Main South Westland Road at Hari Hari.

This paper was finished in January 1938, and in what follows *unclimbed* or *unexplored* should be read accordingly.

The Bulletin of the Mikonui Subdivision No. 6 (N.Z. Geological Survey) directed by Dr. J. M. Bell and P. G. Morgan, defined in 1908 the natural features of the Westland valleys between the Taipo and Wanganui. The valleys between the Wanganui and Wataroa rivers have only recently been explored and have been described in detail only in the *N.Z. Alpine Journal* (Dunedin) and the *Canterbury Mountaineer* (Christchurch).

At the head of the Frances Glacier the Main Range runs W.S.W. veering to S.W., of mixed rock and snow. Past Snowy Peak the crest of the Divide is heavily corniced on the Canterbury side. The highest points are the twin

peaks of Mount Tyndall 8287 and 8262 feet. Falling to the south in sharp snow slopes, the rocky cap of Baker Peak (7400) protrudes from a gentle plateau on the Westland side to fall steeply to the Wee Macgregor glacier some 1000 feet below. At Quoin Peak (7100) the range turns west to the steep rock of Outram Peak (8100), thence in serrated contour to Beta Peak. From Beta (7800) the Divide turns S.W. to the unclimbed summit of Mount Edison (7993).

The Adams Range proper begins due west of Mount Tyndall on Newton Peak (8250). Running west over two unnamed virgin summits of broken rock the line of the range drops to the Adams Col, rises over the rocky triangle of Guardian Peak (7500), falls to the Angel Col, and passes over the three jagged peaks of Mount Farrar (7982). From this point the range runs about due west and comprises the several unnamed shark's teeth and the rock massif of the Great Unknown Peak (7500) unclimbed, whence it turns N.W. to maintain a consistent altitude of over 6500 feet till it rises to Mount Adams (7247). Beyond Mount Adams the range falls to the dense belt of rain forest of the lower Wataroa river.

The line of the Wilberg Range runs N.W. from Mount Farrar, over the rocky tooth of Mount Hulka (7721) and the steep ice faces of Mount Kensington (8150). North-west of Mount Kensington the formation is broken with several remarkable gaps with a schist belt running up to Mount Ferguson.

The Speculation Range reaches its highest point in Speculation Hill, 5300 feet, and continues N.N.E. along a grass line varied with sub-alpine scrub saddles and outcrops.

Mount Lambert, estimated at 8050, is a massif of rock larded with generous glaciers and forms the key of the Adams–Lambert watershed.

Passes over the Main Divide are all alpine and more icebound cols than tourist routes. An unnamed and uncrossed saddle between Snowy and Malcolm peaks has not yet been fixed with precision. The most valuable link between Canterbury and Westland at the sector of the Southern Alps under discussion is the Perth Col, at 6800 feet. Access by way of the Wee Macgregor tributary of the Colin Campbell glacier is steep, and late in the season would be barred by immense schrunds. Descent to the Perth Glacier on the Westland side is broken, but a way exists and is feasible early in the season.

Unnamed cols lie between Mount Tyndall and Baker Peak, and Mount Outram and Beta Peak, the first very difficult owing to the serious obstacles in the Colin Campbell Glacier, the latter practically impossible owing to the rock cliffs on the northern side, to say nothing of the difficult approach on the southern wall.

East of Guardian Peak lies the Adams Col (6200) and west of the same peak the Angel Col (6100). Both are readily feasible to well-equipped parties and give straightforward access to the upper Adams *névé*. A crossing of the Adams Col however would necessitate skirting Guardian Peak on its northern slopes. A col could be crossed west of Mount Farrar to the Barlow feeder of the lower Perth.

Between Mounts Hulka and Farrar of the Wilberg Range a high col might be crossed to the upper Poerua. The Iceland Col (7120) between Mounts

Hulka and Kensington looked extremely uninviting. Passes over the ragged range N.W. of Mount Kensington have yet to be discovered.

Between Mount Tyndall and Mount Lambert a wide col looks simple, but the difficulties of descent down the Beelzebub Icefall may be serious.

The Perth Glacier is fed by the generous expanses of the Garden of Eden *névé* which outlet partly into the Eve Icefall. The upper ice of the Perth glacier is only seriously broken between 6500 and 6000 feet; below that level the ice sweeps down the valley and is augmented by the Eve ice. The moraine extends for some half a mile and there is a sharp terminal face of some 80 feet. The icefalls of Cain, Abel, and The Serpent hang steeply down the valley sides and constantly send avalanches of ice to the floor below.

The Adverse Glacier is steep and broken and is forked about half-way between *névé* and terminal. There is little moraine. Traces of rock avalanches from the Great Unknown Peak were plain.

The Poerua Glacier is as yet unvisited. From glimpses from Mount Hulka and the Iceland col, the glacier appeared to have no barrier icefall.

The Adams Glacier is fed on the west by the Arethusa Icefall on the south by the overflow from the Garden of Eden *névé* over the Angel Col, and on the east by the Beelzebub Icefall. Below the upper Adams icefall the Adams glacier pursues a placid course till it is joined by the Arethusa and Beelzebub Icefalls when it spills steeply down the last 1350 feet. The terminal face of the Adams Glacier is at about 2800 feet. Compared with the terminals of the Perth (3400 feet) and Frances (3500 feet) glaciers, the Adams terminal face is one of the lowest in altitude of the Westland glaciers outside the Franz Josef and Fox regions.

The Alpheus Glacier is unvisited and observations could not be secured from the peaks and ridges climbed.

The Lambert Glacier is dealt with in the Bulletin of the Mikonui Subdivision (1908) at p. 60.

The Perth river (tributary to the Wataroa) has its source in the Perth glacier and flows gently west through level shingle and glorious flowers for a full half mile. Then the river drops S.W. into the boulders and bush typical of Westland, and turns N.W. at the Scone Creek junction, below which minor bluffs alternate with level reaches.

On the right bank of the Perth the only tributary of consequence is Adverse Creek which falls over huge boulders at a steep grade of 1 in 5. On the left bank are the Tarn, Teichelmann, Tainui, and Prospectors Creeks which descend from snow-line into steep narrow valleys by formidable cascades and deep pools. The tributaries below Scone Creek are not enumerated.

The Poerua river and its tributaries are quite unknown. It appeared to our party in 1935 that the river descends from the parent glacier through a miniature grass line, thence to deep canyons between the Adams and Wilberg ranges. At one point our observations seemed to show that the river at perhaps 1800 feet was bounded by rock precipices rising on either side to well over 6300 feet, with only a quarter of a mile in an air line between the enclosing ranges. Reconnaissance of this river is likely to be hazardous.

From Speculation Hill, Pearson and I noted that the head of the Hot Springs Creek, tributary of the Wanganui, was an abundant grass line with peculiar schist outcrops indicating a shatter belt, but we were unable to make closer inspection. Below the grass line the creek falls into rock-bound gorges and waterfalls. For the last few hundred yards of its course it flows evenly to the Wanganui at 410 feet, where are mineral springs.

From the terminal face of the Adams glacier the Adams river (tributary to the Wanganui) gushes in a muddy torrent, to be joined on the west bank by the darker Alpheus Creek coming from a hanging valley of *névé*, and rock avalanches. For nearly 2 miles the river runs through the flats half a mile wide, joined by a little creek, unnamed, and a larger creek, the Boulder Pool. Then the river is joined by a cascading creek on the east and pirouettes to the canyon of its most considerable gorge. In this Eblis Gorge the river is choked with giant boulders and the fall of thundering water is terrific. Above the bush appears to interlock the sky and below is chaos. When through Eblis Gorge it is joined by an unnamed tributary to the west and plunges into rock bluffs sheathed with rain forest, joining the Lambert a few hundred yards above the confluence of the latter with the big Wanganui river at 800 feet.

The Lambert river is dealt with by the Bulletin of the Mikonui Subdivision (1908) at p. 53.

Mount Tyndall and Baker Peak were named by an early survey party from the Clyde valley. J. H. Baker was the companion of Samuel Butler on his explorations in 1861. The Adams range was named after an early Westland surveyor, Charles Williams Adams. The Colin Campbell and Frances glaciers were named in the sixties by J. B. A. Acland. Hot Spring Creek is also an early name.

Snowy Peak and Newton Peak were named by Dr. E. Teichelmann in 1911, the latter after his climbing companion Canon H. E. Newton.

Perth Col and Quoin Peak were named by R. E. Clark in 1933, the latter because the divide bends at right angles at this point. Adams Col and Beta Peak were named by S. H. Barnett, and Outram Peak by L. K. Wilson, all in in 1933.

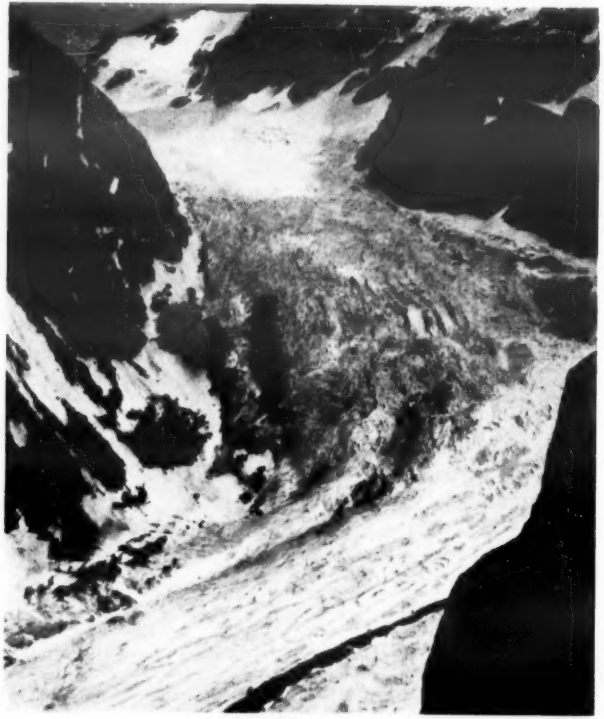
The Garden of Eden was named by A. P. Thomson in 1934 to provide a group of names, for the Adams Range: the Eve, Cain, Abel, and Serpent icefalls naturally followed. Adverse Glacier, Tarn Peak, and the Great Unknown as a cornerpost in virgin country, were named by J. D. Pascoe in the same year.

In 1935 H. M. Sweney named Guardian Peak and J. D. Pascoe named Angel Col and Beelzebub Icefall in relation and contrast to the former. Speculation Hill was named by A. F. Pearson, and Iceland Col by Pascoe.

In 1936 J. D. Pascoe, with Shelley in mind, named Arethusa Icefall and Alpheus Creek, thinking that in leap-year it was permissible for fair Arethusa to chase the dark Alpheus; he named also Boulderpool Creek, and Eblis Gorge with reference to the monarch of evil spirits in *Vathek*.

I am particularly indebted to C. Holdsworth, a companion on many climbs, and to W. G. Harding for all they did in plotting my observations and drawing the map; and must thank also B. Andrews and H. M. Sweney for their help in it, as well as W. Gunn and R. E. Clark for various information.

5. Lower end of Wataroa Gorge



6. Beelzebub Icefall

7. Terminal face of Adams Glacier and Alpheus Creek

8. Guardian Peak: Lower Adams Icefall and river flats

THE LOG OF THE *HERO*

ARTHUR R. HINKS

A MATTER left unresolved in our review of Professor Hobbs' memoir "The discoveries of Antarctica within the American sector" (*see Geogr. J.* 94 (1939) 309–30) was the conflict of evidence between Palmer's biographer Spears (1922) and Colonel Lawrence Martin, on the content of the log of Palmer's sloop *Hero* for the days 15–24 November 1820. Spears gave on the strength of it a circumstantial account of a voyage from Deception Island to the north round Livingston Island during those days; Martin relied on it to prove a discovery of the Antarctic Continent on the early morning of November 18. Colonel Martin had read a paper to the American Philosophical Society in 1937: 'The log of Palmer's discovery of Antarctica,' of which a summary had been published in *Science* for 18 February 1938, had been reprinted in *Congressional Record* for March 1938, and had formed the substance of a communication to the International Geographical Congress at Amsterdam in July 1938. But no transcript of a single sentence from that log for the critical days in November had ever been published, and one was naturally curious to see how it was possible that two people could read a log so differently. So when by March 1939 the paper which had been described as *in press* in July 1938 had not appeared, we made inquiry of the American Philosophical Society and were told that the manuscript had not then been received; while until that paper was published the Library of Congress was unwilling that anyone should have photostats of the log.

2. In February 1940 Colonel Martin read another paper, on the First discovery of Antarctic land by Captain Palmer, to the Polar Symposium held in Philadelphia; but that paper did not appear in the Symposium Volume received in August last, and we understand that it was withdrawn for the inclusion of further material. Just, then, when the hope of resolving our problem seemed to recede, it was a particular pleasure to receive by the Lisbon Clipper early in October a letter from Colonel Martin enclosing photographs of the desired eight pages from the log of the *Hero*, with the news that the October number of the *Geographical Review* would contain an article including facsimiles from two different logbooks of the *Hero* and from other contemporary documents. A little later the article came to hand, with the title 'Antarctica discovered by a Connecticut Yankee, Captain Nathaniel Brown Palmer.'

3. It contains reproductions of the log for the ship's days of 12, 14, 16, and 17 November 1820 and for the period 9 January to 22 February 1821; of a memorandum of two extracts from the log of the brig *Frederick* for 14 and 28 January 1821, and an account in the same hand of the seals collected from the camps by the sloop *Hero* between November 27 and January 12; of a page from another log of the *Hero*, under a different master, for the day 21 December 1821 in the following season; and part only of a letter written by Palmer to F. T. Bush on 13 March 1876. All these are from manuscripts in the Library of Congress.

4. The log of the *Hero* for the season 1820–21 is written in a book with

lines numbered for each hour of the day, with columns headed for speed, course, wind, etc., and compartments at the end of each day for bringing up he distance by account. But the entries pay no attention to lines or columns; they run right across the form and into the margin; they are written in a fair regular hand, remarkably straight, with hardly any variation within the twenty-four hours or from day to day. When the day's entry is short, a second day is sometimes included in the page designed for a single day; when it is long the entry is sometimes run over the printing and so difficult to read in the photograph: otherwise there is only occasional doubt of a word.

5. Colonel Martin says nothing of how the sealers kept their logs: whether in a rough book or on a log-board, to be fair-copied daily into the log. He says nothing of the practice of owners in requiring or not that ships' logs should be turned in to the owners after each voyage. The document now called the log has somewhat the air of being a transcript from the real log; and it was preserved by the Palmer family, not by the owners of the Stonington fleet. One would like to see a critical examination of the book as a whole, with these considerations in mind. But whether it is the original fair log or a transcript makes no difference to the principal difficulty that Colonel Martin reveals by his reproduction and description of a single page: the log is very incomplete; from Tuesday January 9th to Thursday 18th there is only one line for each day, a note of the weather with which it commenced at noon; then comes the date Friday 19th with no entry, and immediately following—these are all on one page and reproduced in Fig. 6—"Thursday 22th Febry Commences with Fair Breese from West at 10 P M Got/Underweigh For Sea in Company with Express Frederick/and Hersilia at 11 were clear from the Harbor" on the way home to Stonington. So for forty days there is practically no log.

6. Colonel Martin finds an explanation "not hard to seek." Palmer was not primarily interested in exploration but in sealing. He had a crew of only four, including the two mates, and they were perpetually tired. "Posting the logbook was necessary, but the entries were held down to the minimum. They were largely limited to records relating to navigation and sealing." But since neither navigation nor sealing has a single word in this so-called log for forty days, the explanation is inadequate. It is much to be wished that the Library of Congress shall publish a complete reproduction in collotype of this document which has been made so much of, but of which so little is known to us. At present we do not even know when the log ceased to record anything more than the weather at noon. Colonel Martin admits on p. 543 that "it does not give the full story" from January 14 onwards; his reproduction in Fig. 6 shows that the record fails from January 9, and from that date back to November 24 we know nothing of the content, except for a few sentences quoted or summarized by Spears.

7. Colonel Martin has reproduced the log for the days November 12, 14, 16, and 17, so that the text is available. He has kindly sent us the photographs of the log for the eleven days November 14–24 for the purpose of resolving the contradiction we had remarked between the interpretations of himself and of Spears; he will allow us to transcribe from these photographs the text for the days November 15 and 18–21 which are essential to our understanding

of the case. It will be convenient to print them line by line as they were written, without that interpolation of running comment which in his text sometimes distracts us from what Palmer said himself. Since the day of the log begins at noon, but our narrative uses the civil date from the preceding midnight, we print that date for convenience at its approximate place on the right of the page and letter or number the lines consecutively for easy reference. The few words which cannot be deciphered are represented by an appropriate number of *x*'s.

8. *Pages from the log of the* Hero

Transcribed from Martin, Fig. 6

No seals up — November 12th 1820

Sunday November 12th

a Commences with Thick weather fresh
b Breese from N by E—at 4 P M saw Castle
c Rock stood in from Ragged Iland at
d xx 8 being in the mouth of the harbor
e we were Boarded by a Boat from the
f Hersilia Capt Sheffield he Informed
g us that he had Been in 12 days and
h that the Frederick and Freegift Capt Pendleton
k & Dunbar were in a harbor on the oposite
l side of the strait at 10 came Too alongside
m the Hersilia. Let go the sheet anchor in
n 4 fathoms middle part thick snow storm
o the Express outside—at 8 A M the Express came — *Nov.* 13
p in Got out the Boat went over to President Harbor
q at 10 went alongside the Frederick & Freegift
r Ends with Pleasant weather no seal up

No photograph of log for the 13th available. Spears (p 56) says that the *Hersilia*, *Express*, and *Hero* were this day all anchored in President Harbor.

Transcribed from photographs sent by Col. Lawrence Martin with letter of 19 *September* 1940.

Tuesday November 14th 1820

1 Commences with Thick and Rainy
2 Weather wind at N W—the Express and Hersilia
3 Boats Busy Landing spars Casks wood &c&c
4 Getting clear for Work—middle part Thick
5 snow storm wind light at N W — *Nov.* 15
6 Latter part thick fog. Light winds at N W
7 At 9 P M went on shore with Capt Dunbar
8 shooting Gulls xxxxxxxx &c &c with great success
9 Capt Dunbar with Mr Pendleton Dined
10 with us
11 Ends with fine weather and Light winds
12 at NNW

Wednesday November 15th

13 These 24 hours commences with Thick weather
14 Light breese from N W . at 2 P M clearing off

Got underweigh on a cruise stood over for Deception
course East for the North head wind Light at
N by W at 8 Being close in with the Land Tacked
to the Northwd Middle part Thick snow
storm. at 12 xxx Reefd the mainsail Tacked *Nov.* 16
to the Ewd at 5 made the Land stood Along
to the Sd and Ed saw what we thougt to Be a harbor
Lowered Down the Boat and Examined it but
were Disappointed stood along to the southwd saw
an Opening stood in found it to be a spacious harbor
with very Deep water 50 & 60 fathoms got out the boat
to sound found anchorage about a mile and half from
the mouth. at 11 we came too in 18 fathoms off the mouth
of a Lagoon went on shore and got some eggs
Ends with Thick weather and calm

Thursday November 16th

Commences with fresh Breese from N West
and cloudy at 2 P M got underweigh to
Beat up the Harbor stood over to the south
shore sounded along and found no anchorage
at 6 P M got up to the head in very sudden
shoal xx our water to 2½ fathoms and came
too—middle part thick snow storm at
5 A M went into a Lagoon with the Boat *Nov.* 17
sounded it out found plenty of water from
5 to 3 & 2 fathoms. went to another farther Dxxx
sounded in 15 fathoms at the Entrance and
10 7—6—5 within found it to be an Excellent
Harbor secure from all winds Returned
on Board Got underweigh at xx we were clear
from the Harbor stood over for the Land Course S by E½
Ends with fresh Breese from S W and Pleasant

Friday November 17th

These 24 hours commences with fresh Breese
from SWest and Pleasant at 8 P M got ovr under
the Land found the sea filled with imense
Ice Bergs—at 12 hove Too under the Jib Laid
off & on until morning. at 4 A M made sail
in shore and Discovered—a strait—Tending
S S W & N N E. it was Literally filled with Ice
and the shore inaccessible wthought it not Prudent
to venture in we Bore away to the Northwd
& saw 2 small Islands and the shore every where
Perpendicular we stood across towards freeseland
Course N N W. The Latditude of the mouth of the
strait was 63.45 S End with fine weather wind
at S S W—

Saturday November 18th 1820

Commences with fine weather Light winds
from W S W—saw a Plenty of whales and Ice
Middle part Pleasant. at 2 A M hauled Down
the mainsail Laid off and On under Freesland *Nov.* 19
at 4 made sail Running along shore course by

compass N N E at 6 Discovered the mouth of a
Harbor stood in got out the Boat went on shore
got one seal—at 10 came Too in a fine harbor
in an Iland about 2 miles from the straits mouth
in 10 Fathoms fine holding ground and went on shore
Sunday November 19th
Got 6 skins & a Quantity of Eggs—found a fine Beache
for seal—at 4 P M got underweigh got out the harbor
wind Dying away Towed her in again middle
part fresh Breese from S W—at 4 A M got underweigh got *Nov.* 20
out the harbor wind Dying away got out the Boat found
fine harbor firm Beaches for Sail Ends with calm
Monday November 20th
Commences with calm Pleasant weather
at 2 P M got up to the head found a Passage
out to the westward on the Larboard shore
the starboard side being filled with Islands
Dunbars—&c found a fine Plain 2 miles in Length
& 1 in Breadth and fine harbors—Navigation
appearing Dangerous On the North side several
Reefs Lying off 5 & 6 miles—at 3 we started got
on Board at 5 the ship having been becalmed
all the time we were absent. stood out to sea
Middle part Calm with Light airs—
Latter part Light Breese from S W to N West *Nov.* 21
at Meridian Freesland Point Bore N by E
4 Miles Distant
Tuesday November 21th
These 24 hours commences with Light &
Variable winds from S W to N W at 4 P M shut
in thick—with a fresh Breese from S W
at 9 anchored in President Bay with
the Fleet—Latter part Fresh Gales from
S West with hail squalls

9. *Notes upon the log*

Line *c*. The name may be read Rugged Island as on Powell and modern maps. In spite of the word *from* the harbour must be on the island, and presumably Hersilia Cove.

Line *p*. President Harbor is presumably the New Plymouth of Powell and Weddell, on Livingston Island, not on Rugged Island as Hobbs has it.

Line *r*. On the words "No seal up" Colonel Martin concludes that the financial success of the expedition was at stake, the five crews were idle, that decisive action was required, and that Captain Benjamin Pendleton of the *Frederick*, commodore of the fleet, came over to the *Hero* with Captain Dunbar, master of the *Free Gift*, to plan a remedy and send Palmer to search for new rookeries. Now it is clear that the Mr. Pendleton of Line 9 who is mentioned after Dunbar cannot be the Commodore, but is Harris Pendleton, probably then mate of the *Free Gift*, who succeeded to the command of the *Hero* when Palmer was promoted in

Clarence I
Elephant I.
SOUTH SHETLANDS
King George I.
Greenwich I.
Livingston I.
McFarlane Str.
Yankee Harbour
Half-moon I.
Mt Brunsfield
Mt Jacquinot
Presidente Harbour
Metvilla Cove
Rugged I.
Deception I.
Trinity Land from Brunsfield's chart
Tower I.
Trinity I.
Trinity Peninsula
BRANSFIELD STRAIT
Palmer Archipelago
Hughes Bay
Palmer's Land from Powell's chart
Line of land from Smith's chart
Anvers Island
GRAHAM LAND
Pendleton Str.
Marin Darbel Bay
ADELAIDE ISLAND
Marguerite Bay

the next season. They just came to midday dinner with Palmer before he sailed, and the crews of the other ships were so far from being idle while waiting for his return that by the time he came back they had thousands of prime skins ready for him to transport to the ships: see Martin, Fig. 7 and our § 3.

Line 16. This seems to be the first use of the name Deception; on Smith's map (Map F of our review of Hobbs) it is Edwards I. The concealed crater-harbour to which it presumably owes the name was unknown to Palmer until he found it on this voyage. Hobbs gives the name of the harbour as Port William or Yankey Hbr. (p. 41); Martin says Port Williams, often miscalled Yankee Harbor. But whether William Smith in the brig *Williams* had been there before him, or whether Palmer was the first to find the harbour and gave the name Deception before he wrote up the log is far from clear.

Line 16. If the word *head* is rightly transcribed it seems clear from what follows that Palmer sailed round the north of Deception Island and down the east coast, not by the west and south as Colonel Martin has it on his map Fig. 2.

Line 21. At the Scott Polar Research Institute in Cambridge Mr. Brian Roberts has a tracing of a running survey by *Discovery II* in 1935 which shows an apparent opening half-way down this east coast of Deception I. Roberts has seen it later himself at closer range: there is a fresh-water lake in it separated from the sea by a sandbar with no opening: which may explain line 23. It is shown also on French Hydrographic Chart 5449 (1912) from Charcot.

Line 28. This must be the fresh-water lake on the flat promontory N.W. of Port Williams (now Whalers' Bay of Admiralty Chart 3205) where Wilkins made his landing-ground in 1928 (*Geogr. Rev.* 19, 1929, Fig. 7, p. 356). The lake has now no visible outlet to the harbour (Roberts).

Line 35. This shoal water must be that off the beach in Telefon Bay.

Line 37. The Lagoon is a small fresh-water lake S.S.W. of the beach, discharging by a small stream up which a boat could now hardly be taken (Roberts).

Line 39. This must be Pendulum Cove, a good harbour a century ago, but now much filled with moraine and mud (Roberts). See also Nordenskjöld; and Voyage of *Chantecleer*.

Line 43. The photograph sent us from the Library of Congress has a blot between the words *at* and *we*. On Colonel Martin's reproduction in Fig. 6 the blot has been erased and the figures 10 written in.

Lines 44 and 48. To the rhetorical question: Did Palmer name the land he had discovered, Colonel Martin answers "Yes and no. . . . He modestly named Antarctica 'the Land' with a capital L." But since in line 49 he hove Too with a capital T under the Jib with a capital J, his use of the capital L does not seem to us to be so significant.

Line 54. When they bore away to the northward Colonel Martin says "It was only noon." The narrative seems to make it several hours earlier, since before noon they had passed "two small islands" which

"were, of course, Ohlin Island and Tower Island," that on Admiralty Chart 3175 are shown, as by Charcot, about 20 miles north of the Orleans Channel mouth.

Line 55. Tower Island is a lofty imposing mass about 5 miles long: it cannot be one of the two small islands.

Line 56. Colonel Martin says that Friesland, spelled in various ways, is an American name that antedates the successive names Livingston Island and Smith's Island. The succession is inverted, since Smith's name was used only by Weddell, while Livingston has survived until now. The name Friesland is not found in Hobbs' list of South Shetland names (pp. 40–42). Martin identifies Friesland with Livingston from the "geographical positions of Friesland Point and Friesland Peak" but does not give those positions. See note on line 87.

Line 57. "The latditude of the mouth of the strait was 63.45 S." The use of the past tense confirms our conclusion that the strait had been left astern well before noon. Neither here nor anywhere in the known pages of the log is any mention of a meridian sight for latitude nor is the position by dead reckoning anywhere given, not even at noon, nor is there any determination of the ship's speed.

Line 64. The mouth of a harbor is perhaps only the entrance to McFarlane's Strait (Powell and now), Duff's Straits (Weddell), or Yankee Sound, if Martin has found that name, which he uses, in unpublished parts of the log.

Line 65. There are likely beaches on both sides of the strait's mouth (Roberts).

Line 66. The fine harbour in an island is presumably what looks like another breached crater, shown by Powell, and by Weddell (Johnson I.), and in the sketches of Martin's Fig. 5.

Line 67. This must be Half Moon Island, surveyed by *Discovery II*.

Line 74. The log does not even say on which side of the strait this second fine harbour was. Martin assumes that it was "the true Yankee Harbour" of his Fig. 2, called Hospital Cove by Powell and Fanning's Harbour by Weddell; and Yankee Harbour is the only other harbour about there which can be called fine (Roberts).

Line 76. If as we must suppose from the context the "head" was the northern exit of McFarlane Strait the boat was more than 10 miles from the ship they had left becalmed in the strait, rather inadequately manned: for while Spears implies that the ship's company was eight or nine, Martin reduced it to seven for Amsterdam, and now to five, the master, two mates, and two seamen. Not liking the look of the northern coast they returned to the ship in two hours, found her still fortunately becalmed, and stood out to sea, evidently from the context to the southward, at five in the afternoon of November 20.

Line 81. *Discovery II* has charted and described as very dangerous the waters between the northern entrance to McFarlane Strait and Desolation Island (Roberts).

Line 87. At noon on the 21st Friesland Point bore north by east, and as they were on the way back to President Harbor, or Bay as it is called in

line 92, joining the fleet there at 9, it does seem clear that Friesland must be Livingston Island.

10. All this being so, one must agree with Colonel Martin that Spears had read the log very carelessly when he could write that Palmer had cruised to the north round Livingston Island; and agree also that "another author, writing from Philadelphia, . . . did not read the right portion of the logbook." Now that we have been allowed to read part of it for ourselves, the particular difficulty which we found in October 1939 has been resolved. The log is fair evidence that on the morning of 18 November 1820, and not on some day in the following January as was supposed until recently, the *Hero* was somewhere about 63° 45′ S. and that Palmer saw the land which his friend Powell showed on his map of 1822 as Palmer's Land, though south of 64°. But Bransfield and Smith in the brig *Williams* had already seen the same land on 30 January 1820.

11. On p. 538 Colonel Martin says: "There is no convincing information suggesting that the Antarctic mainland was seen in 1819–20 by . . . the British trader Captain William Smith . . . or the British naval officer Captain Edward Bransfield." Now on p. 311 of our review of the Hobbs Memoir we wrote:

> "The positive evidence that Bransfield discovered the Antarctic Continent is: first the chart with his signature which is in the Hydrographic Office (Map C); secondly the account of the voyage in the *Literary Gazette* (Document III); and thirdly the confirmation in Smith's map drawn by Goddard (Map F [1]). Professor Hobbs refuses to accept any of these as genuine, and we for our part refuse to accept his judgement of them, for reasons which we shall set out in detail. There is nothing in the whole of his arguments which shakes the authority of these three documents; we therefore maintain that Bransfield with Smith in the brig *Williams* discovered the Antarctic Continent on 30 January 1820."

If Colonel Lawrence Martin, Chief of the Division of Maps in the Library of Congress, accepts the thesis of Professor Hobbs that two manuscript maps in the collection of the British Admiralty are spurious he should say so. If he does not accept it, but uses his somewhat ambiguous words "convincing information suggesting" with some subtle meaning which evades our own conclusion, he should explain what his words signify; for he has received, acknowledged, and read our review of Hobbs containing the above passage.

12. We doubt if Colonel Martin was justified in saying at Amsterdam that Palmer determined geographical positions creditably. There is no indication in any part of the log we know that Palmer ever took a sight, or even kept up his position by dead reckoning; the latitude he gives in the log for the mouth of the Orleans channel looks more like an estimate: and the position on Powell's map from his information is at least 20 miles farther south. He gives no position for Deception Island, not even for the mouth of

[1] This is also in the Hydrographic Office, and its pedigree is complete and unquestionable. See our review, p. 317 of the *Journal* for October 1939.

the concealed harbour: nor any indication of the position or even of the distance to Yankee Harbour. Mr. Brian Roberts, who has sailed these waters with Norwegian coastal whalers and sealers, says that to this day most of them never use charts, nor take sights, nor even work up dead-reckoning positions: they prefer to nose about by memory and instinct.

13. For Amsterdam Colonel Martin wrote that Palmer did not plot his observations into maps. He now reproduces two rough pencil sketches without any scale from among the Fanning documents of the A.G.S. On p. 541 he says they "may well have been drawn by Palmer"; in the title to Fig. 5 that they were "probably made by N. B. Palmer"; and in the footnote on p. 529 that they were "drawn by the master of the *Hero*." In the same footnote he calls the letter written by Palmer on 13 March 1876 a "contemporary document," and accepts Palmer's statement therein more than fifty-five years after the event: that he told Bellingshausen "we was the first Vessel that had circumnavigated the Shetlands Group and had to make our own charts—from which he took a copy on Tissue paper." Colonel Martin has read but ignores our demonstration from the Russian's journal and detailed track-chart that the ships could not have been in touch for more than three quarters of an hour, and that the legend of the meeting which accrued in later years is richly embroidered (*Geogr. J.* 94 (1939) 320–3).

14. We come now to the second cruise of the *Hero*, from 14 to 28 January 1821, during which, we are now asked to believe, Palmer sailed down the coast of Graham Land to Marguerite Bay in 68° S. Upon this the log of the *Hero* says nothing at all. Since before Christmas, according to Spears, Palmer had written each day only a single line, of the weather at noon. He gave even this up on January 17 and wrote not a word more until February 22. Colonel Martin understates the case when he says that "it does not give the full story of this cruise."

15. There is however among the documents reproduced a transcript in the same hand as the record of seals brought in: Figs. 6 and 7. It runs thus: 'In the Brig Frederick log book Jany 14th 1821 says "the sloop Hero Captain N. B. Palmer Sailed to Eastward to look for more seal Isds" same log book says on Jany 28/21 "6 A M the sloop came in after examinning North East and South West to their satisfaction for Seal found none. . . ."' Colonel Martin says this summarizes Pendleton's record of the cruise on which the littoral subsequently called Graham Land or Graham Coast was discovered, and that the genuineness of this evidence is confirmed in two ways, which in fact support only the genuineness of the transcription of the log, not of the evidence which Martin at this early stage reads into it. He remarks also that "Pendleton did not assert that Palmer had discovered no previously unknown islands or stretches of mainland coast": just as Bryce, when he picked up a piece of wood on Ararat would not swear that it was not gopher wood.

16. On 18 February 1821 one Daniel W. Clark, said to be first mate of the brig *Hersilia*, wrote from Deception Island a letter addressed to the editor of the *New Haven Journal* which was reprinted in the *Providence Gazette* of May 9. It contains the phrase: "We have been as far south as 66 deg. and found land." Colonel Martin considers that the plural pronoun was employed

in a general sense, and that the letter "gives no definite evidence that Clark himself sailed southwestward with Palmer": he is sure of Palmer but not of Clark, though Clark said *we* and nothing of Palmer. The document becomes a little later "Clark's letter about Palmer's going to or beyond 66° S." and a few lines further on "Clark's announcement concerning the January voyage of the *Hero*." But this is the method of the Bellman in *The Hunting of the Snark*: I have said it thrice: what I tell you three times is true.

17. In 1828 Mr. J. N. Reynolds made a report to the Secretary of the United States Navy from which Colonel Martin prints a passage thus: "On the northern part of Palmer's land, and in latitude 66° 05′ S, and about 63° W. longitude, Captain Pendleton [actually Captain N. B. Palmer] discovered a bay, clear of ice, into which he run for a great distance, but did not ascertain its full extent south."

18. On 19 December 1910 Dr. Charcot read a paper to the R.G.S. which was published in the *Geographical Journal* for March 1911. On p. 211 Charcot wrote: "Almost exactly in the latitude indicated by the American whaler Pendleton we succeeded, by passing between some of the more widely spaced of the Biscoe Islands, in making our way into a vast bay encumbered by ice. The details given by Pendleton prove without question that he did cruise in this region. . . ." After the first Pendleton Colonel Martin introduces in square brackets ["the American sealer Palmer"], and after the second [to Reynolds, referring to Palmer's cruise].

19. In 1844 at Hongkong the U.S. Consul F. T. Bush entertained a British Admiral and Captain Palmer, and in the *New London Daily Globe* of 10 September 1881 gave an account of Palmer's conversation. Professor Hobbs thought it was from memory, but it now appears that Palmer had written to Bush the letter of 13 March 1876 which is reproduced in part by Martin in Fig. 7: so Bush as a fairly early authority is eliminated; his memory had been refreshed in 1876.

20. Palmer's letter, already quoted in § 13, speaks of the services rendered to Bellingshausen "in extricating his ship from a dilemma he found himself. when the Fog lit up surrounded by land and other obstacles." We have already shown from Bellingshausen's journal and chart that all this story of the fog and the dilemma is a fantasy; and if Palmer had, fifty-five years later, come to believe it himself, he may well have been wrong in thinking that he told the Russians of a "trip to the south in Latt 68°."

21. Finally, on 30 April 1879 Alexander S. Palmer wrote to an inquirer (perhaps F. T. Bush): "My brother discovered Palmer Land latter part of January or first part of February 1821. He proceeded as far south as 68° south Lat. in Long. 58° and 60° and odd west of Greenwich. No one had ever circumnavigated the Shetland Group before."

22. To sum up this evidence for a voyage by Palmer to 68° south in the course of his cruise from 14 to 28 January 1821: His own log says no word of where the *Hero* went. Pendleton's says only that they went off N.E. and came back from S.W. having found no seals; and if Pendleton was then as is generally assumed at Port Williams in Deception, or Yankee Harbour in McFarlane Strait, this would fit the circumnavigation of the South Shetlands

that Palmer claimed he was the first to make. Clark says *we*, which might very well mean the *Hersilia*; but Palmer was in the *Hero*. Reynolds says that Pendleton went to 66° S. and Colonel Martin alters the name to Palmer. Bush heard a story in 1844 but did not publish it until 1881 after Palmer had retold it to him in 1876 and perhaps his brother in 1879. Could there be a less convincing case for Palmer's alleged voyage so far down the Coast of Graham Land.

From what is now known of the *Hero's* log one may conclude that Palmer, when he had anything new to say, did it well: his description of Deception is clear and we can follow his course precisely. When he got down to the south he stayed only a few hours at most, saw little, did not much like what he did see, and came away north again on his principal duty and interest of looking for beaches. He examined McFarlane Strait, found the harbour that was much used later by his compatriots, and gives a fair account of his day there, that shows he was a bold sailor. When after collecting the catch of the sealing camps he was sent on another cruise he kept no log at all: and surely the natural conclusion is that he had nothing important to say. We may dismiss as mere speculation the suggestion made by Colonel Martin that Palmer may have kept a pocket note-book, or may have written on the pages said to have been torn out from the back of the log. Clark in 1821 wrote home of a voyage to 66° S. but no one until lately has even suggested that Palmer had anything to do with this. Reynolds in 1828 went to Stonington to gather material for a report to the Secretary of the Navy: heard something of a voyage to 66° S. but ascribed it to one of the Pendletons. Fanning in 1833 wrote a full though inaccurate history of the time, gives Palmer every credit for visiting the land which got named after him, gives a misleading account of his second voyage there in the following year, but no suggestion whatever of the alleged voyage to the south, either to 66° or to 68°. Then in 1844 Mr. Bush had Palmer to dinner to meet a British admiral, and the table talk on that occasion was dimly remembered thirty years later; so Bush wrote to Palmer for details, and in his reply of 1876 is the first mention of "our trip to the south in Latt. 68°."

Our position is then that documents in the Hydrographic Office of the British Admiralty prove that Bransfield and Smith saw the land which we now know is the mainland of Antarctica on 30 January 1820, and that Col. Lawrence Martin's proof from the log of the *Hero* that Palmer saw it on 18 November following in no way entitles him to call his paper in the *Geographical Review* "Antarctica discovered by a Connecticut Yankee." We do not consider that he has found any good evidence that Palmer sailed down the coast of Graham Land to 68° S. in January 1821.

This paper refers several times to our review of Professor Hobbs' memoir (Geogr. Jour. October 1939). A reprint of this review can be sent to any student of Antarctic history who desires a copy.

A PROBLEM IN JUBALAND

NOTES BY COLONEL E. H. M. CLIFFORD, CAPTAIN E. N. ERSKINE AND MR. A. T. CURLE

A NOTE on this subject in the *Journal* for January 1938 brought us further contributions to a discussion of the problem, which was to have been undertaken by one of the writers when, as was expected, the others came home on leave. As this has not been possible, it seems well to summarize the several contributions as best we may.

Several accounts of stone buildings in Northern Jubaland, later included in Italian Somaliland, said that they were attributed by the Somali to a race of giants, the Maanthenle. On this Lieut.-Colonel E. H. M. Clifford wrote in February 1938:

> Ghosts of the Maanthenle certainly people Jubaland and the country immediately to the west; and the local Somalis have a good many legends about them, nearly all of which have the common feature of emphasizing that they were a race of giants. In the basin of Wajer Dima there are, if my memory is not at fault, about three hundred wells as described by Colonel Salkeld. According to legend, the Maanthenle bored these with their spears, twirling them fire-stick fashion. At Wajer Bor the wells are similar, though wider; but I do not remember any stories relating to their origin.
>
> Northwards from the Lak Dera, the country is mainly dependent for the conservation of its water-supplies on artificial water-holes, attributed as Colonel Salkeld says to this race. They are numerous and their siting is skilful. In a great many places there are what appear to be very old clearings with scanty secondary vegetation, just below an artificial water-hole. This would suggest that the clearing was made for cultivation; and indeed according to legend they were the gardens of the Maanthenle. Of course the Somalis are new-comers to this region, and it is very convenient for them to account for anything obviously old by labelling it as the work of this legendary race.
>
> The general impression left on my mind is that the Maanthenle may have been Nilotic. Their complete extinction, according to the Somalis, was due to some terrible epidemic. Alternatively, the rainfall nowadays would be totally inadequate for the cultivation already referred to; possibly it was heavier centuries ago, and as it dwindled these people migrated elsewhere and were absorbed into other races. If so, their giant stature does not appear to have attracted attention.
>
> The ruined stone wall and houses at Birkao (Colonel Salkeld's Burkow, shown as Port Durnford on naval charts) are now well known and have, I believe, been studied in recent years. They may have a totally different origin, such as a post for sea-borne trade made by a foreign race.

At the suggestion of Colonel Clifford a copy of this note was sent to Captain Esme Erskine, who wrote in March 1938 from Khartoum:

> The article calls these giant people Maanthenle. To my ear the Somali refer to them as Maardenli, or more correctly Maardenleh, there being a

peculiar Somali twist to the last syllable. . . . The Somalis probably named them giants from their surviving works: deep wells bored through rock and large earth dams. As the Somalis make nothing, these appeared to them as the work of giants. It is accepted that the wells through the soft limestone were made by alternate firing and cooling, which method of rock cutting is well known to most natives and I have seen it so employed in Abyssinia.

The Somalis attribute the total disappearance of these giants and their cattle to two causes. A great plague killed off the people: the thigh bones of their skeletons were two paces long. Alternatively, flying dragons ate up all the cattle and the giants fled the country.

No well or water has ever been discovered at Bendiger, although the 3-mile-long circumference wall and the fosse and the stone cairns bear evidence for a population of thousands where one cannot exist to-day for want of water. The Somalis say the giants filled in the wells and went away. I think that when the enemy captured Bendiger they filled and levelled the wells to prevent occupation. I further doubt that the Maanthenle had much to do with Bendiger. Part of the wall is loopholed, and possibly it was used as a depot on the great slave route which led to the coast from Uganda and Southern Abyssinia *via* Bardera to the port of Mogadishu.

Birkau near Port Durnford I know well. I do not think that the Rendille had anything to do with the building of any stone works on the coast or were ever at Port Durnford.

I once made a four-days' voyage in an Arab dhow to the Bajun islands on my way to Birkau to collect arms, and the Bajun islanders told me their forefathers used to live on the Maanthenle wells at Wahjeir in the centre of Jubaland, and that when the Somali invasion came the remnants fled to Birkau and Port Durnford and made canoes and went to the Bajun islands off Kismayu, where they were depleted by passing slave dhows.

Meanwhile Colonel Clifford had written to Mr. A. T. Curle in Tanganyika, who in September 1938 sent us the following note:

I have read with great interest the notes on the walled ruins of Bendiger which appeared in the *Geographical Journal* of January 1938. I had heard of these ruins from natives, and there is a strange likeness in the information I collected from Gurre tribesmen on the Dawa River in 1926 and 1927 and that collected by Colonel Salkeld on the Coast. There is no doubt that the Gurre have a legend that at one time their tribe were builders in stone. They cited a building in Ethiopia on the upper waters of the Dawa, and irrigation works on the Ethiopian bank of the Dawa opposite Yabichu, in support of the tradition. I was never able to visit any of these works.

The connection between the Gurre and the Rendile is explained by tradition in the following way: during the time when the tribe inhabited the country to the south of the Juba, west of Serenli, there was a period of drought and the whole tribe decided to trek with their stock to the east, moving together for security. After many days' slow progress the inevitable discontent arose and one of the old men, called Sheikh Momin, assembled

the leaders to decide what they would do. All agreed to follow the Sheikh except one section which went off "to the right hand," *i.e.* to the south, ended up near Lake Rudolph and became the Rendile. I believe their camel brands, certain customs, and points in their language are still similar to those of their parent tribe, the Gurre. They are referred to "as those who went to the right on Momin's day." The use of the term sheikh may be a modern embellishment to the story, as it is unlikely that the Gurre were at that period converted to Islam. The similarity in the build and appearance between the two tribes has been mentioned elsewhere, and Arkell-Hardwick's description of the Rendile 'An ivory trader in North Kenya' tallies with that of the Gurre.

The main body of the Gurre went "to the left," across the Juba near its mouth, and back into the country between the Webbe Shibeli and the Juba whence they are supposed to have come many generations earlier. The gradual pressure of the Somali tribes from the north forced them south again, back across the Juba. The Somalis no doubt grazed their stock on the north of the river while the Gurre used the southern side; as more Somali villages filtered down so they would gain in strength and try to push on. Raiding parties of warlike Somalis would be a perpetual curse to all within 30 miles of the river. One has only to compare the state of affairs on the Kenya–Ethiopian boundary in 1925 when the Ogaden Somalis from Ethiopia looted twenty-five thousand head of stock from less warlike tribes in Kenya. It was no petty raiding of the neighbouring tribes which the Gurre could normally cope with themselves but some major danger which must have induced such a construction as the walls of Biniga, which I think is the more correct spelling.

Camels and other stock are most vulnerable to raiders when grazing in the bush, spread over a wide area, herded by the women, youths, or children, as they usually are in the cases of nomadic tribes. At night, with a group of villages concentrated, men are on the spot and protection is easier, likewise when watering the stock is herded together and easier to protect.

It is not unreasonable to suggest that a walled enclosure within a grazing area would provide a refuge where villages could camp and into which stock could be driven if warning of raiders was received. The Somali lacks patience to sit down and besiege a place and relies on swift raids into the enemy country, driving off the loot before a body of men can be collected to follow; if a place were defended he would pass on looking for some easier prey. Thirty miles is within raiding distance from the Juba. Permanent water at 10 miles away would be no difficulty in the circumstances, as every nomadic household often lays in seven days' supply of water at a time. The size of the perimeter, some 3 miles, and the lack of buildings within the walls, would support the suggestion.

The Gurre are not a warlike people and are an easy prey for the Somali with his born knowledge of raiding, with scouts, rearguards, and flank-guards. During the Great War the Kenya Government issued arms to the Gurre to enable them to defend themselves, but they sold the arms to the Somalis who raided them and in many cases redeemed their stock which had been looted.

The Somalis first crossed the lower Juba in 1842, and it was not until 1848 that they drove out the Wardeh who inhabited that area ('Jubaland and Northern Frontier District handbook,' p. 108); if one may assign a slightly earlier date for the crossing of the Upper Juba, the area being more in the line of the direct Somali movement, one can assume that they became a potential menace to the Gurre about the early part of the nineteenth century, and I consider it possible that the walls of Biniga were constructed about that time. The Gurre to-day are living to the south of the Italian Somaliland–Kenya boundary and well within British territory.

I do not connect the walls of Biniga with the Maanthanle; in no case that I know do any of the remains attributed to this people take the form of wells or burial cairns, connected with a building. Wells of the Wajir type mentioned by Colonel Salkeld are also found at Walwal, but 80 feet deep, and in the river bed at Dagahbur in Ethiopia on the northern edge of the Ogaden country; others of the same type, which I have not seen, are said to exist at Warder which is about 10 miles south-west of Walwal. There is little doubt that the wells would have been dug slowly. Each of the groups, Wajir, Walwal, and Warder, is in a large basin, and as the country dried up following a wet cycle the people would follow the water down; it would be a gradual process and there would be no question of water diviners or well sinkers.

The problems of the ancient history of North-East Africa can be solved only by the gradual collection of data. I have myself written on the subject: "Prehistoric Graves in the Northern Frontier Province of Kenya," in *Man*, June 1931; and "Ruined Towns of Somaliland," in *Antiquity*, September 1937, etc.; but the more one looks into the problem the larger the task appears. A chief difficulty is that administrative officers, soldiers, and travellers often dig into a cairn, grave, or other ruin, find a few pieces of pottery, and fail to record their efforts.

I am writing without my complete notes, and it is some years since I had any dealings with the Gurre.

In his covering letter Mr. Curle regrets that no effort has been made to survey these ancient monuments in Socotra, British Somaliland, and Kenya. In the second there are more ruined towns than modern.

The photographs of Bendiger reproduced came from Lieut.-Colonel G. C. Hill with the material which made the initial note in January 1938.

Great circular wall with loopholes, Bendiger

Outside the wall, Bendiger

Remains of a building, Bendiger

A NEW MAP OF ANTARCTICA

HANDBOOK AND INDEX by E. P. BAYLISS and J. S. CUMPSTON to accompany a MAP OF ANTARCTICA. *Canberra: Commonwealth of Australia Department of External Affairs*, 1939. 10×6½ *inches; 90 pages; map*

THE Preface to the Handbook is written by the Minister for External Affairs, whose Department collected material from many sources, and by the Minister for the Interior, whose cartographer compiled and produced the map. Mr. J. S. Cumpston, for the former, has brought together, in the chapter Antarctica, a very useful summary of work since 1925 by the ships of the Discovery Committee, the B.A.N.Z.A.R.E. under Sir Douglas Mawson in 1929–31, the Norwegian expeditions of and for Mr. Lars Christensen in 1926–37, Admiral Byrd's expeditions of 1928–30 and 1933–35, the flights of Sir Hubert Wilkins and Mr. Lincoln Ellsworth, the British Graham Land Expedition of 1934–37, and the German Antarctic Expedition of 1938–39.

A brief introduction to this chapter recalls that Captain Cook was once "bold enough to say that no man will ever venture farther than I have done: and that the lands which may be to the south will never be explored." It quotes also from Lars Christensen the improbable compliment to Palmer put into the mouth of Bellingshausen by Palmer's biographers, which we have recently discussed (*Geogr. J.* 87 (1939) 322). The first landing on any part of the Continent "other than the northern parts of Graham Land" was made from Bull's ship *Antarctic* in 1895, though the expedition led by Borchgrevink in 1898–1900 called its book 'First on the Antarctic Continent.' This exception of Graham Land seems to overlook the fact that Biscoe's landing was on an island. After a very brief summary of events between 1900 and 1910, in which neither Scott's first nor Shackleton's first expedition is mentioned, we come to the culmination of the non-mechanical period in 1912, and after the long gap caused by war the beginning of the post-war period with the first voyage for the Discovery Committee in 1925. A statement of the Imperial Conference of 1926 on existing British titles by virtue of discovery should surely have been prefaced by some mention of the Falkland Islands Dependency proclaimed in 1908 and the Ross Dependency in 1923. And since in making the map "the principle adopted in the choice of names has been in general that the ultimate decision on the names to be adopted in any territory lies with the Government of that territory," it would have been well to mention the Order in Council of 1933 establishing the Australian Antarctic Territory, which was not proclaimed in the *Commonwealth Gazette* until 1936. These four important dates are relegated to a later section IIIb on Boundaries.

The summary of fifteen years' continuous work by the *Discovery*, *Discovery II*, and *William Scoresby* is placed first in its proper precedence, as the finest example of a scientific enterprise directed always to ends of urgent importance, to understand the physical conditions and the natural laws which govern the life of the whale in its immense and until lately badly surveyed habitat. It has been a race with time, to learn how the catching might with international good will be wisely regulated before the profits to be snatched from unlimited pelagic whaling with factories and catchers on the high seas did irremediable damage.

Rivalling the Discovery Committee's work in extent, with larger forces and somewhat different aims, came the Norwegian enterprises controlled by Lars Christensen, combining enormous commercial interests with an ambitious and very successful programme of scientific exploration and survey. The earlier

cartography is in the charts of the Norwegian Whalers' Association; the other scientific results already make a fine series of volumes published by the Norwegian Academy of Sciences; and one may add to Mr. Cumpston's excellent chronicle that the air surveys are or were being worked up with the stereoplotter of the Norges Geografiske Opmåling.

Arising directly from the Imperial Conference of 1926 came the expeditions of Sir Douglas Mawson in 1929–31, promoted by the Commonwealth and New Zealand Governments, assisted from Great Britain by the loan of the *Discovery*, and supported financially by Sir MacPherson Robertson and other Australians. Largely upon the results of this timely enterprise was based the Australian claim to its Antarctic Territory, with its curious *enclave* of Adélie Land, of which the coast was discovered by Dumont d'Urville in 1840, was surveyed by the Australasian Antarctic Expedition in 1912, was proclaimed a National Park and Nature Reserve by the French about 1926, and was converted into a French sector by Decree of 1 April 1938.

A merit of these accounts, and of those that follow, is that they are dry compilations of events, dates, and names, quite impersonal and uncritical: the author has collected the bare facts from the extensive scattered literature and condensed the history of twenty years into fifty pages. Such economy makes it impossible to give references to authorities. An exception is made for Discoveries in Graham Land (1819–1937) compiled for use with a small map of Graham Land inserted at the end of the book, with an attempt, not quite successful, to assign the first discoveries in this debated region. To Bransfield is given a short piece of Continental coast eastward from the mouth of the Orleans Channel, to Palmer and Powell (who never was there) the coast south and south-west of Trinity Island. The three seem to share between them the discovery of Deception Island. It would want a map on a much larger scale and a different representation, by track rather than by area, to disentangle the history.

Table IIB gives a list of the "authorities" using the word rather loosely, for they are not always the original authorities: one would not expect a memoir of the American Philosophical Society dated 1939 to be cited as the authority for H. Foster in 1829 or J. B. Charcot in 1908–10.

How the map was compiled is described by Mr. E. P. Bayliss, Cartographer to the Department of the Interior. All available documents were consulted, and additional information was collected from recent explorers themselves. The map is the first to show the boundaries assigned to Lands within the Australian Antarctic Territory. The bathymetric contours have been replotted by taking into account over five thousand modern soundings additional to those shown on Admiralty Charts up to 1937. The place of the Magnetic Pole has been recomputed by Dr. C. Coleridge Farr, and a table of former determinations is given on the map; it appears to be moving north-westerly about 4 miles per year. The map is plotted on the Azimuthal Equidistant projection, to which is attributed the curious property that all great circles pass through the centre of the map and are represented by straight lines intersecting at their true angles.

There are lists of Geographical Positions accepted, additional to those given in the Antarctic Pilot 1930 and Admiralty Charts; a table of Boundary Definitions with the authority; a most useful statement of the authorities accepted for each segment of coastline and for topographical details; and a Bibliography of works consulted, though not necessarily followed; with, finally, an Index to names on the Map.

Such a Handbook provides a most valuable critical apparatus for studying the map, and the authors as well as their Chiefs are to be congratulated on having gathered so much into a slight book of ninety pages.

The map is excellently printed in eight colours by the Government Printer, Canberra. It is produced from the same drawings in two sizes: a single sheet with engraved surface $27\frac{3}{4} \times 36\frac{1}{2}$ inches, the latitudinal scale 1/10M, with inset of the Australian Antarctic Territory's coast on 1/7M; and in two sheets, with a small overlap, $37 \times 25\frac{1}{2}$ and $37 \times 24\frac{3}{4}$ inches; with scales $1/7\frac{1}{2}$M and $1/5\frac{1}{4}$M. The projection is Polar azimuthal equidistant; the horizontal meridian is 0° left to 180° right so that 90° east is at the top, and the A.A.T. in the upper half; the names are written more or less parallel to the lower edge, so that the map can be read in one position; in all these matters the map differs from the Admiralty South Polar Chart No. 1240, which is on the gnomonic projection, has 180° at the bottom, and names along the parallels, to be read from the South Pole at the centre. Heights and soundings are in metres instead of in feet and fathoms. The boundaries of political sectors, the subsidiary divisions of sectors with Lands and Coasts, are shown in red, instead of being omitted; the inland topography, mountains and glaciers, is well drawn in colour.

The Commonwealth Government take a firm line in the matter of names: they are the only authority on names within their Antarctic Territory. They have exercised this authority with a generous regard to the desires of explorers and the feelings of their countrymen, so that few principal names proposed by any side have been omitted, though some have been given a Coast instead of a Land. Only Wilkes has both, and the extent of his Land, no less than 34° of longitude, should have made it unnecessary for an American Professor to weary the Symposium at Philadelphia in February last with his tale of British perfidy, while having to admit in his last sentence that Wilkes had after all obtained his deserts.

The A.A.T. has henceforth nine Lands, bearing the names of Oates, King George the Fifth, Wilkes, Queen Mary, the Kaiser Wilhelm II, the Princess Elizabeth, Mac-Robertson, Kemp, and Enderby, in that order from east to west. To the Coasts within these Lands are assigned the names Wilkes, Banzare (B.A.N.Z.A.R.E.) Sabrina, Knox, King Leopold and Queen Astrid Coast, formerly Princess Astrid Land (but a different Astrid), Ingrid Christensen, and Lars Christensen. One cannot but regret that Lars Christensen, who has done so much for the exploration of these Lands between 90° E. and 20° W., should not have a Land of his own; but his officers coveted for him one of the few important stretches of coast for which he is content to accept in the main the survey of others; and his maps proposed names entirely of the Norwegian Royal Family for the sector between 45° and 20° W. which Norway has since claimed, with an overriding name Queen Maud Land, and subsidiary Lands, not Coasts, for the Crown Prince Olav, Prince Harald, Princess Ragnhild, Princess Astrid, and the Crown Princess Martha.

In other parts of the map we may note that Roosevelt Island is accepted, under the Ross Barrier behind the Bay of Whales; that the Barrier is called the Ross Ice Shelf, and the same order of words is used for what Rymill named the Wordie Shelf Ice. The Eternity Range, so vaguely defined by its discoverer, is placed rather far east of his course; and Livingston Island is spelled, we think correctly, when the Admiralty Chart has Livingstone. On the face of the map there is a table of determinations of the South Magnetic Pole, and in the inset label a list of Dependencies, with the Decrees creating them and the Gazettes publishing them.

The bathymetric tints of the sea are nicely graded, and the map has been made just large enough to include the South Sandwich Deep, below 8000 metres, discovered by the *Meteor* and surveyed by *Discovery II*. The writing seems to us too large, so that where names are many, as about Graham Land, they are too

crowded; and its character, especially in the numerals, is undistinguished. But in all other respects this map of Antarctica is a distinguished performance that makes the Admiralty Chart with its old-fashioned contempt for colour look a poor thing; and one wishes for it and the Handbook a sale to encourage the promised new editions. A. R. H.

REVIEWS

EUROPE

LE SPIAGGE DELLA RIVIERA LIGURE. By M. Ascari, L. Baccino and G. Sanguinetti. (Pubblicazioni del Comitato Nazionale per la Geografia. I. Ricerche sulle variazioni delle spiagge italiane. No. 3.) *Rome*, 1937. 12 × 8½ *inches;* vi + 328 *pages* + viii *plates; illustrations, maps, and plans.* L.35

In 1930 Professor L. de Marchi published an article on the retreat of the coast between the River Piave and the River Tagliamento, and included evidence of a similar retreat in the Po Delta. Both he and Professor Toniolo, who worked near the mouth of the Arno, considered such changes to be a temporary phase resultant upon a climatic fluctuation (*vide* note in *Geogr. J.*, vol. 77, p. 201).

In 1933 the Italian National Research Council instituted an inquiry into coastal changes, and the Geographical Institute of Pisa University was made responsible for the direction of the work. A preliminary volume, published by Dr. Dina Albani, took the form of a review of the state of knowledge of coastal changes at that time. Albani divided the coast of Italy into ten major divisions and showed that most of these experienced advance in the early nineteenth century, and retreat by 1900. He estimated that only 7 per cent. of the coast was being eroded in 1800, but that at the beginning of the present century the percentage was about 70. Finally he discussed the causes of so uniform a change of shore-line movement and suggested that, of several groups of causes, slow movements of the earth's crust were fundamental while other factors were essentially local in their effects.

In 1936 the Italian National Research Council published the volume on Mediterranean Shorelines by D'Arrigo. A number of portions of coastline are considered with reference to their bathymetric variations and to sea-floor deposits. The particular areas discussed include the Nile Delta, the Po Delta, the Tiber, the northern end of the Adriatic, the Rhone Delta, and the neighbourhood of Algiers, but there is no continuity between them. The prominence of delta shorelines leads one to feel that the findings are not necessarily a fair sample of the Mediterranean region as a whole. The general conclusions suggest that wave action does not function as deep as sediments occur: coarse-grained sediments are found down to 10 metres and finer material occurs down to 100 metres, a fact that lends plausibility to the theory which emphasizes the importance of marine currents as distinct from wave action. The time variations associated with deposition, erosion, and stability are considerable, and the importance of storms is duly emphasized and summarized in the conclusions. The areas considered are illustrated by a series of folding coloured maps which should prove of great interest even to those who do not read Italian.

In 1937 the first of the more detailed monographs was published. The main

part of the volume is by Ascari, who deals with the western portions of the Ligurian coast. The work is excellently illustrated by a large number of photographs and includes a bibliography of nearly three thousand references. Ascari stresses the importance of the irregularity of the coastline with respect to exposure to the prevalent storm winds from the south-west and to the deposition of material in sheltered stretches. While realizing the lack of data for earlier periods, he claims that erosion must have proceeded along the rocky stretches of the coastline since Roman times. From the late seventeenth century onwards records become more reliable and more numerous, and can therefore be shown on the maps. Changes in more recent times have been considerably restricted by artificial means.

To illustrate the value of the maps, the plans of the Genoa area may be briefly discussed. Three maps have been selected, each centred on one of the following settlements: Voltri, Pegli, and Cornigliano. The coast at Voltri faces slightly east of south and shows a general tendency to advance from 1823, the date of the first record; it is sufficiently sheltered from the prevalent winds to be an area of accumulation. At Pegli, the coast has remained rather more stable with the result that one finds some stretches more advanced to-day than at any previous recorded date, while others lie farther inland than ever before; local influences of shelter and exposure are the vital features. Except for an apparent advance between 1751 and 1811 of about 100 metres, the story at Cornigliano, with its more south-westerly aspect, is one of retreat, the 1935 line being usually the most inland of all.

Considering the Western Ligurian coast as a whole, as illustrated in Plate VI, in 1935, the retreating coast totalled nearly 50 kilometres, about 35 kilometres evidenced stability, and advance is recorded for only 7, while high or controlled stretches accounted for the remaining 70.

The eastern portion of the Ligurian coast is dealt with by Baccino as far east as Camogli and then by Sanguineti from Portofino to Cap Corvo. Both these contributions run on similar lines, and are similarly well illustrated.

H. C. K. H.

IN OLD ROMANIA. By HENRY BAERLEIN. *London: Hutchinson and Co.*, 1940. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* 288 *pages; illustrations and sketch-map.* 12*s* 6*d*

This book is mainly concerned with an account of the author's travels through Moldavia from Jassy to Bucharest at the time of the Ruthenian crisis. It is written throughout in a conversational style, and makes entertaining reading; though the high standard of wit attributed to many of his acquaintances sometimes strains our credulity. There is clearly no attempt made to take geographical matters into consideration, nor is it the kind of volume to which one would go in search of information, but it does succeed in conveying "atmosphere" which in these days is of some account.

Anyone who has enjoyed Romanian hospitality will appreciate what Mr. Baerlein has to say about the warmth of his reception; though it would have been a subtle and not altogether undeserved compliment to his hosts if some of the events in which he participated, notably the bear hunt and the rain-making ceremony, had had, at any rate in the book, a more successful ending.

As we travel the Moldavian countryside with the author we get intimate glimpses of the tangled skein of religious and superstitious beliefs which play such a prominent part in the everyday life of the peasantry. What promises to be an interesting first-hand account of the activities of a group of university students, whom the author met in an Oltenian village preparing to make a local sociological survey, is suddenly cut short to make way for a final chapter which,

nevertheless, strikes a happily symbolic note by introducing us to a couple of shepherds discussing the merits of a newly discovered sacred well.

There are several excellent photographs and a map, though it would have been a small improvement if Iasi in the latter had not become Jassy in the letterpress (or vice versa). R. A. P.

CHILTERN COUNTRY. By H. T. MASSINGHAM. (The face of Britain.) *London: B. T. Batsford*, 1940. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* v + 120 *pages; illustrations and end-paper maps.* 8*s* 6*d*

Mr. Massingham in this survey of the Chilterns avoids rigorously the conventional compilation of the antiquarian or the local chronicler. The account of his wanderings and musings probes sufficiently into the natural environment to assist the reader in grasping the conditions amid which the life of the countryside has evolved. The theme of the book is the balance between man and nature achieved here until the last few years. He stresses the former relative isolation of this pleasant agricultural tract, with its associated rural industries largely dependent upon the woodlands, and traces with affection the surviving relics of this way of life. His sketches of scenery are therefore punctuated with characteristic tilts at "science, progress, combines, and all their devilments," for which parts of the Chilterns to-day afford only too much support. Occasionally his judgments are rather biased, for example his suggestion that the change from arable to grassland was promoted by importers of cattle cake. But whether one believes as fervently as the writer in a "golden age" or not, there is much to interest and to entertain in his pages. As is usual in this series, the photographs are excellent and varied.

AUSTRALASIA AND PACIFIC

THE STORY OF THE PACIFIC. By HENDRIK VAN LOON. *London: George G. Harrap*, 1940. $9 \times 5\frac{1}{2}$ *inches;* 316 *pages; illustrations.* 8*s* 6*d*

Mr. van Loon's latest book, after a start which suggests that it is to be travel reminiscences embroidered with reflections on the present state of the world, continues as a fairly straightforward account of the exploration of the Pacific. It is distinguished by the emphasis placed upon the "discovery of the Pacific by the Polynesians," an achievement which he regards as "the most magnificent in the whole history of navigation." This section is followed by a rapid review of the present condition of the native cultures faced by the disintegrating effects of European influences. Here the author shows himself critical of the work of missionaries. The concluding chapters describe the more important European voyages from Magellan to Cook, a subject which in general outline offers little scope for originality. The author endeavours to overcome this by what must be called imaginative reconstruction of the motives of the voyagers. Equipped with an inquiring and restless mind and an individual style, he makes his points forcibly and demonstrates the significance, for the natives and for world history, of European intrusion into this ocean. A few slips in detail do not seriously detract from the main purpose of the book.

POLAR REGIONS

SIR JOHN FRANKLIN'S LAST ARCTIC EXPEDITION. The Franklin Expedition. A chapter in the history of the Royal Navy. By RICHARD J. CYRIAX. *London: Methuen and Co., Ltd.*, 1939. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* xviii + 222 *pages; maps.* 12*s* 6*d*

It is almost a century since Franklin sailed on his last, most famous and most

disastrous expedition; and it might be thought that that ill-fated, over-optimistic foray into the Arctic, and the protracted bungle which followed the total and lasting disappearance of all its members, had by now been discussed to the point of exhaustion. Apart from such contemporary polemics as King's 'The Franklin expedition from first to last,' and Brown's 'The north-west passage,' there is McClintock's imperishable 'Fate of Franklin and his discoveries'; there is Gilder's narrative of Schwatka's search for Franklin's records; and there are the Franklin biographies by Traill and by Admiral Markham. Yet it is only Mr. Cyriax's due to say that no book yet published covers the whole tragic, yet splendid story so adequately, and so dispassionately, as his. McClintock told, and professed to tell, no more than how he, with one puny ship and a handful of comrades, accomplished a task—the discovery of Franklin's fate—in which many far better equipped official expeditions had most conspicuously failed; Gilder's book is equally personal, and only describes the gleanings of a well-reaped field; Traill's 'Life' is a well-written book by the wrong man; and while Markham was well acquainted with his subject, his work is diffuse, and shows few traces of research or independent judgment. Mr. Cyriax has brought, to what has obviously been a labour of love, an open, well-balanced mind, indefatigable research, and extreme accuracy in points of detail; and the result is a book which all students of the subject will find invaluable.

It is divided into three parts. Part I deals with events leading up to the sailing of the *Erebus* and *Terror* in May 1845. One chapter is devoted to a concise sketch of previous attempts to make the North-West Passage, indicating how much had already been done, and what was left for Franklin and his men to do. Then come full accounts of personnel and material; short biographies of the principal officers; a full nominal list of the ratings; and complete details of the ships and their provisioning and equipment. It is interesting to learn that their 20-h.p. auxiliary engines—the first, except for the futile Braithwaite and Ericsson power-plant which was installed in Sir John Ross' *Victory* and subsequently thrown overboard, ever to be sent to the Arctic—were adapted railway locomotives, and that the *Terror*, on trial under steam alone, showed herself capable of 4 knots! Here, as elsewhere, the author has made full use of a mine of information hardly worked hitherto: the Admiralty records in the Public Record Office. A full précis is given of Franklin's somewhat verbose Official Instructions; but it would have been an advantage if the crucially important sections 5 and 6 of these—which prescribe the route to be followed, and whose ambiguity helped to lead the various Naval relief expeditions so very far astray—had been given verbatim. This part closes with the last recorded sighting of the *Erebus* and *Terror*, by the whaler *Enterprise* (not the *Prince of Wales*, as is generally stated) on or about 31 July 1845.

Part II deals with the various searches; first with the official expeditions sent out to find and relieve the missing explorers and then, when it had become painfully certain, or almost so, that every man must have perished, with the private ventures which continued the quest after the official searches were abandoned, and ultimately discovered a considerable number of relics, the last resting-places of many of the starving, scurvy-stricken personnel, and the only first-hand MS. account of the Franklin expedition's doings and sufferings ever brought to light: the famous record found by Hobson, of McClintock's expedition, in the cairn at Victory Point. This portion of the book begins with Sir James Ross' abortive expedition of 1848–49, and ends with the work of Messrs. Gibson and Skinner (1931) who discovered some graves and relics at the Todd Islands and on the south coast of King William Land (*Geogr. J.* 79 (1932) 402–408). Mr. Cyriax justly points out that Ross came much nearer to success, and

surmised Franklin's position and the cause of his detention much more correctly, than is generally realized. An interesting account is given (pp. 92, 93) of a little-known Scottish lawsuit, determined in March 1858, in which the Court of Session held that Lieut. James W. Fairholme, of the *Erebus*, must have died, at the latest, during the autumn of 1851.

Part III of the book is both the longest and the most valuable. In it Mr Cyriax gives a temperate, detailed, and careful analysis of all the available data, and expounds some very interesting and closely reasoned conclusions as to the causes and events of the disaster which overtook the Franklin Expedition. In the first place, he disposes finally of the "Goldner myth"—the often-repeated legend that Franklin's tinned provisions consisted largely of putrid offal. Next he reconstructs, admittedly with slender data and to some extent conjecturally, the events on board the *Erebus* and *Terror* between September 1846, when they were finally beset off the west coast of Boothia, and April 1848 when Captain F. R. M. Crozier, on whom the command had devolved at Franklin's death (on 11 June 1847), ordered their abandonment. The author advances convincing reasons for thinking (as was first suggested by McClintock) that the winter of 1847–48, the third spent by the crews in the Arctic, was marked by a severe outbreak of scurvy on board both ships: hence the heavy mortality (nine officers and fifteen men) noted in the Hobson record, and the far heavier losses, all along the line of retreat towards the Great Fish River, which dotted the west coast of King William Land with the graves, and sometimes the bare skeletons, of those who—by the Eskimo accounts—"fell down and died as they walked." Mr. Cyriax also gives excellent reasons for accepting the view put forward by Sir Clements Markham as to the main events of that tragic march. On this theory, the crews first made their way over the sea-ice, in a single body, to the land at Victory Point and thence to Terror Bay. On arrival there however many of them were already in such a plight that they could go no further. A "hospital camp" was therefore established, while the main body, taking all spare food available, pushed onward. Some of the stronger of the men left behind at Terror Bay tried to return to the ships for more food; but many of these could not cover the full distance and a second hospital camp had to be made at Erebus Bay. Only a few succeeded in reaching the *Erebus* and *Terror*, which were still firmly beset, and these were too exhausted to make the return journey. Thus the fate of the two encamped parties was sealed. Lastly the main body, making occasional contacts with nomadic Eskimo (who could give them little help and shunned their company) and steadily losing stragglers as they crawled along, crossed Simpson Strait to the mainland and made their last camp at Starvation Cove, where—then numbering, it is believed, some forty in all—they perished to a man.

Mr. Cyriax also discusses the fate of Franklin's two ships. He rejects the identification, in many respects plausible and even striking, of the *Erebus* and *Terror* with the two ships seen in 1852, by the *Renovation*, on an ice-floe off the Newfoundland Banks. He prefers the Eskimo story, according to which one ship (there is no clue as to which) sank somewhere off O'Reilly Island, to the westward of King William Land. The situation of the other wreck remains a much more open question: some evidence, of doubtful value, points to the vicinity of Matty Island, on the east side of King William Land.

A very useful appendix gives details of the various memorials to Franklin and his officers, particulars of their graves, where these have been identified, and short biographies of the junior officers.

The maps are unpretentious, and omit irrelevant detail, but they are clear and informative. Two show respectively the North-West Passage region as known in

1845 (when Franklin sailed) and in 1859 (when McClintock returned), while a third, on a larger scale, covers the King William Land area and the line of the expedition's retreat towards the Great Fish River. A small map in the text also shows this region as it appeared on Admiralty Chart 261 at the date of Franklin's sailing, and is interesting as indicating a possible land connection between King William Land and Boothia.

Finally, a word must be said in praise of the dispassionate judgment and the meticulous care for accuracy which permeate the whole book, and show themselves in many ways: not least in the extreme care which has been taken to furnish chapter and verse for every quotation and to acknowledge fully each case in which use has been made of copyright matter—the latter including, it should be noted, some passages (hitherto unpublished) from McClintock's private journal and from the report made to him by Lieutenant Hobson.

R. T. G.

ECONOMIC AND HISTORICAL GEOGRAPHY

THE VOYAGES AND COLONISING ENTERPRISES OF SIR Humphrey Gilbert, with introduction and notes by DAVID BEERS QUINN. (*Hakluyt Soc., 2nd ser., vols.* 83 *and* 84.) *London*, 1940. 9 × 5½ *inches;* xxx *and* (xiv) + 534 *pages; illustrations and maps.* (*To non-members, Two Guineas*)

In these two volumes Dr. Quinn has collected a mass of documents bearing upon Sir Humphrey Gilbert and his various enterprises, prefacing them with biographical details and a discussion of the complicated issues which they raise. Gilbert's career was a strange tale of frustration: despite grandiose plans and complicated negotiations, which are amply illustrated in these pages, all his schemes fell through or were disastrous failures, and it was left to contemporaries after his death to establish the first English colony in North America. His failure may be explained in part by faults of character, by insufficient knowledge of the obstacles to be overcome, and by the difficulty of securing adequate financial support at a time when to plunder Spanish shipping offered more certain reward. He was by no means uniformly successful as a soldier, was reported to be "of not good happ by sea," had an uncertain temper, and displayed great ruthlessness towards his Irish opponents: yet in many ways he was far-sighted and displayed determination in pursuing his plans. Though success was not to be his, his schemes illustrate the current of thought at an important point in English colonial history.

Dr. Quinn prints material dealing with Gilbert's projects of settlements in Ireland for the light they throw on his later plans; but the reasons for action there were more political and strategical, and it is doubtful if his Irish experiences taught him much that was of use to him later. He was then attracted to the possibility of a north-west passage to Cathay, which he advocated in his 'New passage to Cataia,' 1576. His first voyage however, though the object was not at all clear, appears to have aimed at a colony in the southern hemisphere. After its failure, he turned again to North America, and drew up the detailed plans for a colony of settlement, almost feudal in its conception, in which, under the Crown, supreme power would have rested in his hands. On this last expedition, detailed though Dr. Quinn's exposition is, some points still remain to be clarified. He rejects arguments based upon the Gilbert Map (*Geogr. J.* 72 (1928) 237), believing that there was no question of a search for a north-west passage or of the colonization of Western America. For reasons of secrecy Gilbert never stated explicitly his goal. It is true that the proposed associated expedition of Peckham received from him extensive grants of land "betwene the Cape of

Florida and Cape Britton," and that Gilbert was currently reported as intending to sail for Norumbega (in the Narragansett Bay area). Nevertheless it is difficult to contest the association of the Gilbert Map with Gilbert and John Dee, and after Gilbert's death on the return from Newfoundland, whither he had been diverted by lack of stores, Dee was still interested in the north-west project. Some years earlier, Gilbert had suggested "inhabiting for our staple some convenient place of America," in order to control trade through the passage when discovered, and it may be that the proposed settlement of 1583 was for that purpose.

Dr. Quinn has arranged his material clearly, and gives full references to the sources. The volumes are illustrated with useful reproductions of relevant maps.

THE GOLD RUSHES. By W. P. MORRELL. (Pioneer Histories.) *London: Adam and Charles Black*, 1940. 9×6 *inches;* xi+427 *pages; maps.* 18*s*

The theme common to the Pioneer Histories is the varied manifestations of European expansion over the world, and the subject of Dr. Morrell's book is certainly one of the most characteristic of these. Gold, being widely distributed and in general fairly easily worked, was probably the first metal used by man. Until the late eighteenth century, it was generally obtained from local sources, as in ancient Egypt or medieval Bohemia and Transylvania, though occasionally some passed from trader to trader, as the west African gold reached the Mediterranean in medieval times. But about a century and a half ago the method and scale of exploitation changed: in the author's words: "only in modern times has this thirst for gold inspired vigorous peoples to seek it out by hard labour in the waste places of the earth," and it is with these rushes that the book deals. The movement opens in Brazil and Siberia, but the first real rush was to California in 1848. This and later fields in America, Australia, and Africa, lay almost without exception on the extreme limits of western civilization; in addition to solving difficulties of travel and technique, the miners had to evolve their own social structure, and this aspect is one of the most interesting in Dr. Morrell's study. Though ready to record an entertaining detail or a human trait he avoids the merely sensational in his treatment of human beings undergoing one of the most searching of tests. This common theme and the account of the development of mining technique, from the single miner washing for alluvial gold to the highly organized company treating low-grade ore, give unity to what is inevitably a somewhat disjointed and detailed narrative. He also discusses, perhaps rather too briefly, the permanent effects of this search for gold. It would be difficult to overemphasize the importance of Californian gold in establishing American influence on the Pacific coast, or of the gold mines in the development of the South African railway system. In the history of the nineteenth century the flow of gold exerted far-reaching influence upon world economics, but this is perhaps outside the scope of this study. Some account of the recent development of the New Guinea fields on the other hand would have effectively rounded it off. The author has supplied extensive bibliographies for further research. G. R. C.

THE MONTHLY RECORD

THE FUTURE DEVELOPMENT OF TANGANYIKA TERRITORY

We have received through the courtesy of the Librarian of the Colonial Office a copy of the Report of the Central Development Committee (Dar es Salaam, 1940) appointed by the Governor of Tanganyika in December 1938 to examine the methods by which the development of the Territory by non-native and native enterprise might be encouraged, the place of public works in such a policy, and the cost and financing of the projects recommended. The Report, apart from its importance for the future of the Territory, is valuable as a record of present conditions, and as a contribution to the general problem of colonial development. It is also of much interest to the student of African geography. It is not possible here to summarize the whole Report, but the general policy will be briefly indicated and some points of interest treated in slightly greater detail. An outline map, on the scale of 1/2M, showing railways, roads, and cattle routes, but little topographical detail, is contained in a pocket.

The Committee took a wide view of their terms of reference, and regarded their task as the search for a policy through which Tanganyika "may be made a country." They explain at the outset the reasons why this policy still remains to be determined. Politics and world economics have combined to check the development of this area. Recovery from the war of 1914–18 was slow and the Territory again suffered a set-back in the years of depression which followed 1930, but better conditions returned in 1937 and 1938, justifying the formulation of a long term policy. The Committee stress the need to press on with their recommendations as far as possible despite the present situation. The problems to be solved are certainly considerable: the Territory is large in relation to its population which, further, is unequally distributed and sometimes handicapped by disease. None of its present products command an outstanding position in world markets, and interior distances are great. In the 360,000 square miles of the territory there are approximately five and a quarter million natives, thirty-four thousand Asians, and just over nine thousand Europeans, to whom the Committee look for the impetus towards general advancement. The average of approximately 17·5 persons per square mile is slightly larger than that for Kenya, but one-third only of that for Uganda or Nigeria. Certain areas however are comparatively thickly populated; for example at the northern end of lake Nyasa the density is 40–60 per square mile. In 1939 the domestic exports were valued at four and a quarter million pounds: the revenue, including land sales, Imperial grants, etc., was £2·3 million in 1937, and £2·1 in 1938: in the former year however there was a net revenue from the railways of £83,000, but a deficit of £21,000 in the latter. These considerations justify the claim that any large scale development is well outside the capacity of the Territory's resources.

It is stated that the Territory has in the past suffered financially from the customs agreement with the other East African colonies. Free trade on the northern boundary has operated to the detriment of the Tanganyika railways: commercial undertakings have their headquarters in Kenya, and the earlier start of secondary industries in Kenya and Uganda has discouraged their establishment in Tanganyika. If these colonies were a political and administrative as well as an economic unit, these difficulties would not arise, but at present Tanganyika is being deprived of customs revenue and railway receipts, and a declaration of future policy would be welcomed.

The Committee's recommendations are aimed broadly at ensuring an increased and self-reliant population, with an improved standard of living and

health, based upon a full use of the natural resources. In general they envisage the Territory continuing as an exporting country, producing as much as possible for export, until at least the administrative personnel is mainly home recruited, but they are anxious to develop the home market where possible. It is recognized that this policy links their prosperity up with the course of world prices, but this risk is to be taken as the only means of acquiring a sufficient income to raise the standard of living. The danger of over-concentration on a small number of cash crops is also recognized. Apart from gold, the leading exports are agricultural: sisal, coffee, and cotton. Sisal (average export, 1935–39, £1·47 million) is a plantation crop, and the Committee do not foresee any further expansion. They are anxious that cotton exports (£528,000) should be stimulated by all possible means, and a high standard maintained. Coffee (£442,000) like cotton is exposed to keen competition, but in this case they recommend that the Bukoba growers should concentrate upon a low-grade coffee. The export of ground nuts has fluctuated violently: the highest figure was £360,000 in 1924, compared with an average, 1935–39, of £135,000, and the low figure of £31,000 in 1938, a bad year climatically. It is considered that the present export could be doubled, to 40,000 tons annually. There are good prospects for pyrethrum, used for sprays and insecticides, particularly in the Southern Highlands, where land has recently been alienated for its production. Recommendations are made for improving the quality of hides and skins, the drying of copra, and the storage of maize to meet the home demand. For the livestock industry the necessity for improved pasture, compulsory limitation of stock, and better marketing facilities are emphasized. Where stock routes have been closed by tsetse fly, the Committee are against clearing and maintaining fly-free routes, mainly on grounds of expense, and propose inoculation after infection and provision of watering facilities ; but on the whole question of routes they are very cautious and insist on careful study before expenditure.

The general policy recommended therefore for agriculture is first to induce the native peasantry to plant more crops, while taking into consideration the labour requirements of the plantations, and generally to work more, so that their incomes may be increased for savings or expenditure, not necessarily for further tax payments. Populations concentrated on areas of poor fertility should be encouraged to migrate to empty fertile areas, and no narrow limit on the alienation of land suitable for settlement should be maintained merely for the sake of future generations. It is recognized that for this native policy to succeed, expenditure on education, agricultural instruction, experimental stations, and health services must greatly increase.

The second and perhaps most important point of agricultural policy springs from the Committee's conviction that "the economic structure of the Territory must be made to rest on a broader foundation than African agriculture." In their opinion, government would be justified in spending considerable sums to promote non-native settlement; they have no doubts as to the suitability of parts of the country for white settlement or on the practicability of successfully establishing large numbers of settlers in these parts. They propose that this settlement should take the form of homesteads in group settlements, and should in general be inter-penetrative, *i.e.* native and non-native settlers should not be segregated. The less congested parts of the Southern Highlands are favoured for investigation in the first instance, followed by North Meru, Songea, Ufipa, Eastern and Western Usambara, and other areas. To execute this policy it is proposed to establish a Land Settlement Board, which should be a department of state carrying out a definite and continuous policy; land and agricultural bank facilities; and considerable development expenditure. The problems

likely to arise in attempting white colonization on a large scale are not discussed by the Committee, who however recommend that the Settlement Board should proceed as soon as possible to investigate likely areas, water supplies, access, etc., and to plan for settlement well in advance of its initiation.

The Report gives much space to the development of communications, or rather of the road system, for it is considered that at the present time there is no justification for further expenditure on railways, partly on the score of expense and partly because the services given by adequate roads are considered sufficient. This implies the abandonment of the railway to the south-west which was much studied about ten years ago, and which was examined by several committees: in its place they advocate an organized road service controlled by one contractor in cooperation with the central railway. The Mbosi, Mbeya, and Chunya areas particularly should be included in this scheme, or their traffic will leave the Territory *via* Lake Nyasa and the Nyasaland railway. The various routes proposed for the railway in the past were discussed by Brigadier Jack in the *Journal* for February 1932. It is considered that with improved communications and encouragement the exports from the south-west could be raised in five years to £400,000 a year, the principal crops being tea, pyrethrum, coffee, and tobacco, with possibilities for grain and wool. It may perhaps be pointed out that conditions for white settlement here are not quite comparable with those in Kenya. (See the paper by Mr. C. Gillman in the *Journal* for February 1927.) Between 1921 and 1938 the classified roads maintained by public funds increased from 2605 to 15,018 miles, at a cost of nearly two million pounds: capital expenditure has been mostly on bridges and drainage, and little has been spent on surfacing. Outside the chief towns therefore there is no road capable of carrying traffic throughout the year, and some districts are isolated for three consecutive months, and a higher standard of road maintenance is a prerequisite of any development. The course of the north–south arterial road, known as the Great North Road, which links up with the Kenya and Northern Rhodesian systems at Namanga and Mwenzo, is not entirely justified on economic grounds, but has no suitable alternative. It should therefore be regarded as an Imperial route, and not as a liability on the Territory alone. A proposed alternative route, *via* Iringa, Kilosa, Korogwe, could not economically be continued through Moshi, as this latter portion would probably have disastrous effects on the Tanga Railway. The Iringa–Korogwe portion however is important, and should be treated as an arterial road. These roads, with certain others, particularly one from Dar es Salaam to the Korogwe road, totalling 2500 miles, should be brought up to the strip standard of Southern Rhodesia.

Many proposals were received from provincial committees, a few points from which may be mentioned. In the Eastern Province it is estimated that 200,000 acres of good soil could be opened for settlement in the Kilombero valley, and financial aid is recommended for the establishment there of small holdings for Africans and Asians, with technical supervision and instruction. It is suitable for maize, rice, and cotton, while tobacco, ground nuts, and sugarcane should be considered. Native production in the Rufiji valley should also be stimulated. It is stated that, with encouragement, great development is possible in the Southern Province; one necessity is the restriction of depredation by game. Tobacco producers around Songea should be induced to return to growing a high-grade tobacco. In the Musoma district of the Lake Province, the pastoralists are beginning to supplement their incomes by agriculture, the mines offering a market, and the uncontrolled use of the plough threatens soil erosion. Here an experimental station to determine the best agricultural prac-

tice is necessary. Parts of the Sukuma district are overcrowded with people and stock, and better husbandry requires the migration of some to the plains, where water supplies should be secured by government. The villages should be brought to appreciate the value of, and to assume responsibility for, manuring, contour hedging, tree planting, etc. Congestion is also reported from the Northern Province, in the Mbulu cattle area, and among the Chagga on the slopes of Kilimanjaro, where expansion is also limited by tsetse. This should be met by re-settlement on the plains, the encouragement of mixed farming, and investigation into the best methods of irrigating the mountain slopes. Successful experiments in the control of soil erosion have been carried out in the Kikombo valley, Central Provinces. The methods are the closing of slopes already destroyed, the reclamation of lower denuded slopes, the introduction of rotational grazing, and the prevention of shifting cultivation. The Committee insist that native cooperation, through communal labour, and the control of animal stock, is essential for the ultimate success of such schemes.

To sum up, the schemes recommended by the Committee entail a capital expenditure of £5·9 million, with recurrent expenditure in ten years of £3 million. Some of the main heads of capital expenditure are: agriculture, land settlement, water supply, forestry, etc., £685,000; roads, £3·7 million; medical and health services, £285,000; education, £607,000. In regard to priority, production and transport schemes are in general placed before social services. It is recognized that part of this total is chargeable to general or local revenues, and of the balance it should be possible to repay £4 million.

MINERAL RESOURCES OF SOUTH AFRICA

The Department of Mines, South Africa, in cooperation with the Union Mineral Resources Committee, has issued a new edition of the useful survey of the Union's mineral resources, originally prepared for the third Empire Mining and Metallurgical Congress, 1930. The volume contains a general summary of the topography, geology, and development of the mining industry, followed by a description of the occurrence, exploitation, and future prospects of each mineral. Though there has been development of other resources, the mineral output of the Union is still dominated by gold and diamonds, which made up 90·4 per cent. of the output in 1938. Very large deposits of coal are known to exist: in general these are of low grade and will not stand high transport costs. The export trade however is being maintained, and industrial development will find uses for the lower grades. Copper also stands high in respect of total amount extracted; by 1938 however only one mine was at work, at Messina in the north Transvaal, though preparations were in train to re-open mines in Namaqualand. Much the same may be said of tin: its production has declined in recent years, and now amounts to about 1000 tons of concentrates a year, all of which is exported, mostly to the Straits Settlements. The Union's very large resources of iron ore are as yet scarcely touched: the ore produced mainly at Pretoria and Vereeniging amounted to over 550,000 tons in 1938, and there would be no difficulty in supplying a developing home market. A recent development has been the discovery of large deposits of the platinum metals in the Bushveldt igneous complex of the Transvaal, and chrome, nickel, and tin deposits in association: owing in part to transport difficulties these are not yet being worked.

For three minerals South Africa holds a leading place in world trade. There are extensive deposits of good grade manganese ore, the chief producing area being Postmasburg, 100 miles north-west of Kimberley. In 1938 the output was 620,000 tons, the third largest in the world. For chrome ore the output was

195,000 tons, fourth among world producers. South Africa produces also three of the principal varieties of asbestos fibres, and in 1939 exported over £400,000 worth, half to Great Britain. For these three minerals however the world market is extremely competitive, and the amounts which the home market can absorb is limited.

EXPANDING SETTLEMENTS OF SOUTHERN BRAZIL

The progress of the European settlements in Southern Brazil, and the reasons for their success in contrast to other pioneer areas of Brazil, are discussed by Preston E. James in the *Geographical Review* for October 1940. Southern Brazil is significant as one of the chief areas of German settlement in the western hemisphere, and because the colonies are expanding both in area and in population. Poles and Italians are also important elements. There are physical conditions which explain the differences in settlement north and south of the São Paulo–Paraná border, but these are not the sole reasons. In the south the fertile *terra roxa*, weathered from the diabase, is not confined to a narrow belt but covers practically all the interior highlands: frosts come every year and there is no real dry period: tropical rain forest gives place to lighter semi-deciduous moorlands and savannah to prairie. In Paraná the chief settlements are on the highlands, but Santa Catarina and Rio Grande do Sul, the coastal plains, are the centres of population.

Until well into the nineteenth century this sector of Brazil was very thinly peopled, and it was to secure the frontier that the Brazilian authorities encouraged European immigration. Between 1824 and 1859, twenty-four thousand Germans entered Rio Grande, colonizing chiefly the northern slopes of the Jacui valley. At first the attempt was not very successful, but it flourished with the establishment of rail and water routes to Porto Alegre. Clearing the forest, the settlers grew rye, potatoes, and other familiar crops, but depended mainly on raising hogs on locally grown maize. Between 1870 and 1890 Italians also immigrated and, settling higher up the Jacui, established their customary cultivation in which the vineyard is conspicuous. By 1909 the Germans numbered 200,000, and they increased to 520,000 in the next thirty years. The Italians have also been prolific.

To the north in the state of Santa Catarina development has been slightly different. Six thousand Germans settled in the valleys of the escarpment centring around Blumenau, but this area was not so suitable for close settlement, and the immigrants have spread over all the highlands. Small industries, including paper-making and brewing, serve the urban centres. Of the population of Santa Catarina 40 per cent. is estimated to be of Portuguese origin, another 40 per cent. German, and 20 per cent. Italian. The writer adds that while the Germans have reason to be proud of their achievements, and would be loyal citizens if left alone, they are "peculiarly subject to the influence of agents and organizers, who play on the theme of German solidarity." In Paraná, the most northerly of the three states, though Italian immigrants were the first to enter, Slavic groups are now the most numerous. The initiative was taken by the state between 1876 and 1879 when the carefully planned Curitiba settlement was founded, to supply that city with vegetables, meat, milk, etc., and later colonies have been equally successful. It is now estimated that the state population of one million includes 180,000 Slavs, 126,000 Germans, and 35,000 Italians.

The writer suggests several reasons why settlement in these three states has been more permanent and successful than elsewhere in Brazil: the colonists were carefully chosen; they introduced and were able to develop their varied European diet; good communications were established as soon as possible and

the settlers had access to existing markets, and, in particular, the region was not suited for growing speculative crops, which have had unfortunate results elsewhere. It is true that the region has also a more invigorating climate, but the writer considers that this influence can be exaggerated at the expense of diet and adaptability.

CLIMATIC FORESTS AND DESERTS

In his paper in the November *Journal* on "Deserts versus forest in eastern Africa" Mr. E. J. Wayland raises some meteorological points which invite comment. He says (p. 131) that theoretically, on an ideal or simplified globe, certain zones of vegetation and desert would be expected to correspond roughly with certain belts of latitude. This expectation is presumably derived simply from a rough generalization of the irregular distribution actually found upon the globe. It can hardly be derived legitimately from any theoretical principles for we cannot estimate, even within a margin of several degrees of latitude, the width of an equatorial rain-forest belt upon a globe having a uniform or regular distribution of land and water. This important problem in dynamical meteorology is still unsolved. On the actual globe the equatorial belt of low pressure, though badly deranged in places by monsoons and other disturbing factors, preserves its identity on the whole, and is supplied with air by the converging north-east and south-east trade winds which play an essential part in maintaining the equatorial rains produced by upward convection. Although the position of the equatorial rain belt follows, with a lag, the vertical sun and is no doubt determined by the highest mean annual temperature on the Earth's surface, we could not infer from thermal factors how many hundred miles the equatorial rain belt should cover before giving place to the dry sunny trade wind belts where the temperature in summer is often actually much higher. Here dynamical factors including rotation enter into the problem: we only know that, whether the equatorial belt be narrower or broader, the other so-called planetary belts of wind and pressure, namely trades, temperate westerlies, and polar easterlies must be accommodated both to it and to one another.

Mr. Wayland rightly emphasizes the Sahara as a climatic desert, but it may be noted that this desert is abnormally large and intense for complex reasons not entirely confined to Africa. In winter an axis of high pressure along the northern Sahara maintains steady north-east trade winds southwards. In summer this axis lies over the Mediterranean Sea, in association with expansion of the Azores high-pressure system and development of low pressure over the Persian Gulf directing persistent north-east or north winds over the entire Sahara and Egypt. In either case the prevailing Saharan winds are to a considerable extent of immediate anticyclonic origin, implying descent of air with divergent air streams—a factor conducive to obstinate drought. It might have been supposed that a region so intensely heated as the Sahara is in summer would have generated a pronounced system of low barometric pressure leading to powerful monsoonal indraughts with convergent air currents and heavy convectional rains. This apparently cannot happen because of the proximity of North Africa to the Asiatic monsoon system which dominates the circulation; yet it is significant that in South Africa, which is more isolated from such disturbances, not only do the seasonal equatorial rains extend farther from the equator than in North Africa but also, in latitudes corresponding to the Sahara, there is a well-marked development of summer convectional rains with only a relatively small trade wind desert area in the west.

OBITUARY

PRINCE IYESATO TOKUGAWA

The Prince Tokugawa was head of the great family which from 1603 until 1867 held as a dynasty of Shoguns the effective sovereignty of Japan. In his youth he spent five years in England, and in 1880 became a Life Fellow of our Society before returning home and devoting his great abilities to the public life of his country under the restored authority of the Mikado. He soon became a leading member of the House of Peers, and for the last thirty years was its President. He was President of the Red Cross Society of Japan and of the America-Japan Society of Tokyo, represented his country at the Washington Conference of 1921, and with his nephew the Marquis Hachisuka, also one of our Fellows, was present at our Centenary Celebrations in 1930. We are indebted to Prince Iyemasa Tokugawa for a pamphlet containing tributes to the memory of his uncle, which has been placed in the Library.

LORD LAMINGTON, G.C.M.G., G.C.I.E.

Charles Wallace Alexander Napier Cochrane Baillie, second Baron Lamington, who had been a Fellow of our Society since 1889, died at his Scottish seat in Lanarkshire at the age of eighty on September 16. He was at Eton and at Christchurch, Oxford, where he was a contemporary and became a life-long friend of Lord Curzon. After being Assistant Private Secretary to Lord Salisbury, and for a few years representing North St. Pancras in the House of Commons, he succeeded his father in 1890 and in the same year made a notable journey from Bangkok through the Northern Shan States to Tongking, which he described at a meeting of the Society on 10 November 1891. His paper is published in the *Proceedings*, vol. 13, pp. 701–19. Of this journey 300 miles had not been described by any European. From 1895–1901 he was Governor of Queensland and from 1903–07 Governor of Bombay during the Viceroyalty of Lord Curzon. In 1907 he returned home and engaged in many public activities, being Lieutenant-Colonel of the Lanarkshire Yeomanry, Honorary Colonel of a battalion of the Scottish Rifles, and Captain of the Royal Company of Archers. He was a member of our Council from 1908–12 and Vice-President from 1912–15, and when he was in London was always at the dinners of the Geographical Club and the meetings of the Society. Having in the spring of 1919 gone to Syria as Commissioner of the British Relief Unit, he maintained a continuous interest in the relations of the British with the East, and served terms as President of the East India, National Indian, and Middle East Associations and the Iran Society. In the House of Lords he spoke often in support of modest useful reforms such as the proposal for the adoption of the twenty-four hour clock, and on what was probably his last visit to the House of the Society he was discussing the advantages of that system for the organization of the Society's work and activities in time of war.

COLONEL HERBERT LELAND CROSTHWAIT, C.I.E.

Colonel Crosthwait, having been educated at Rossall and Trinity College, Dublin, entered the Royal Engineers in 1890, and from 1897 until his retirement was an officer of the Survey of India. Here he was employed largely on the geodetic side and published in the *Professional Papers* of the Survey an important investigation upon isostasy in India. In 1902–03 he was seconded for employment on the staff of Colonel Sir Thomas Holdich upon the Argentine–

Chile Boundary Commission, and published in the *Geographical Journal* of March 1905 a paper on the Journey to Lake St. Martin, Patagonia, which contained a little study of the seiches on Lake St. Martin, that is an excellent example of his scientific interest and curiosity. During the war of 1914–18 he was engaged on topographical work in Eastern Persia and afterwards saw service in the third Afghan War and in the Waziristan Expedition of 1919–20, for which services he received the medals, mentions in despatches, and the C.I.E.

On his retirement from the Survey of India in 1923 he was employed as Cartographer to the British Government to the Wembley Exhibition, and became a director of the Aircraft Operating Company, Ltd., and of Aerofilms, Ltd. He had been a Fellow of the Society since 1902 and served two terms upon its Council from 1928–32 and from 1936–38. He died after a long illness on 11 September 1940 at Fleet in Hampshire.

FLIGHT-SERGEANT CHARLES S. TOWNSHEND, R.A.F.V.R., D.C.M.

The staff of the R.G.S. has suffered a serious loss in the death by enemy action of Flight-Sergeant Charles S. Townshend, who was first employed by the Society as a junior in 1913 when it moved to its present home in Kensington Gore. On the outbreak of war in 1914 Townshend immediately enlisted in the Wiltshire Regiment and saw service in Gallipoli and in Mesopotamia, where he rose to the rank of Company Sergeant-Major, was severely wounded and received the Distinguished Conduct Medal. On his return he was taken on to the staff of the Library and earned the respect of his colleagues and the gratitude of Fellows, for his remarkable memory served him and us well in keeping track of the continual re-arrangements necessitated by the cramped quarters of the old House and the re-distribution when the new Library was built. Soon after its formation he joined that section of the R.A.F. Territorial Forces that operates the Balloon Barrage, and from a few days before the outbreak of the present war he had been occupied in the defence of London. He was killed on duty in November.

MEETINGS: SESSION 1940–41

The following have been elected Fellows of the Society:

On 7 October 1940: Albert Everard Gunther; R. W. Patterson; Mohammad H. Rahman; Dr. H. L. Richardson; A. Beeby Thompson; Rev. R. Motson Thompson.

Second meeting, 11 November 1940. Mr. Leonard Brooks, Vice-President, in the Chair

Paper: The productivity, fertility, and classification of land in Britain. By Dr. L. Dudley Stamp

Third Meeting, 18 November 1940. The President in the Chair

Elections: Mrs. Frank Becker; Rowland George Capewell; Eric St. John Bartlett Dowsett; Thomas Haythornthwaite; E. C. Willatts, B.SC. (Econ.), PH.D.

Paper: The rôle of peasant Hungary in Europe. By Miss Harriet Wanklyn

Fourth Meeting, 25 November 1940. Geographical film. Animal life in the Antarctic: described by Dr. N. A. Mackintosh

Fifth Meeting, 2 December 1940. Mr. Leonard Brooks, Vice-President, in the Chair

Paper: Coastal Makran. By Dr. J. V. Harrison

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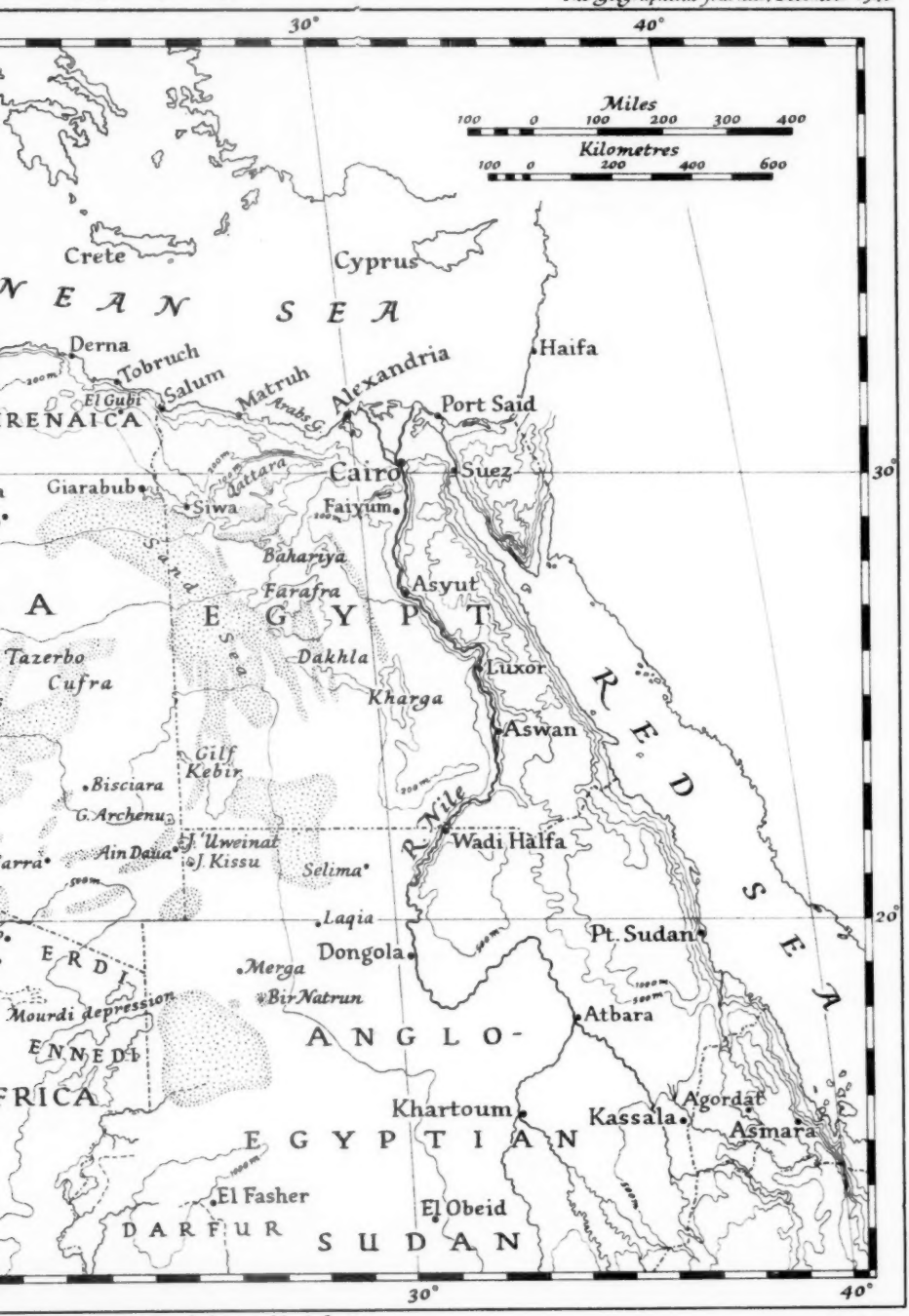
y the paper by Major K.S. Sandford, T.D.

The Geographical Journal, December 1940



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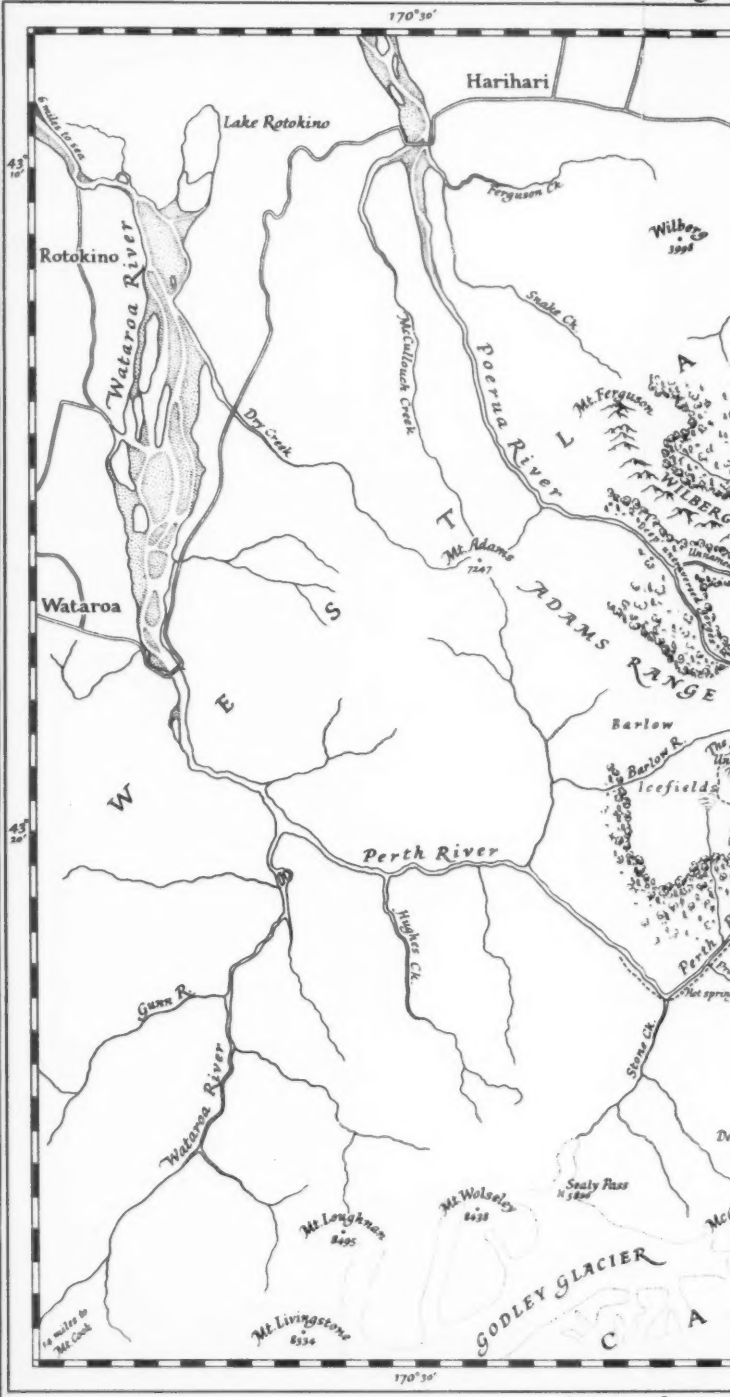

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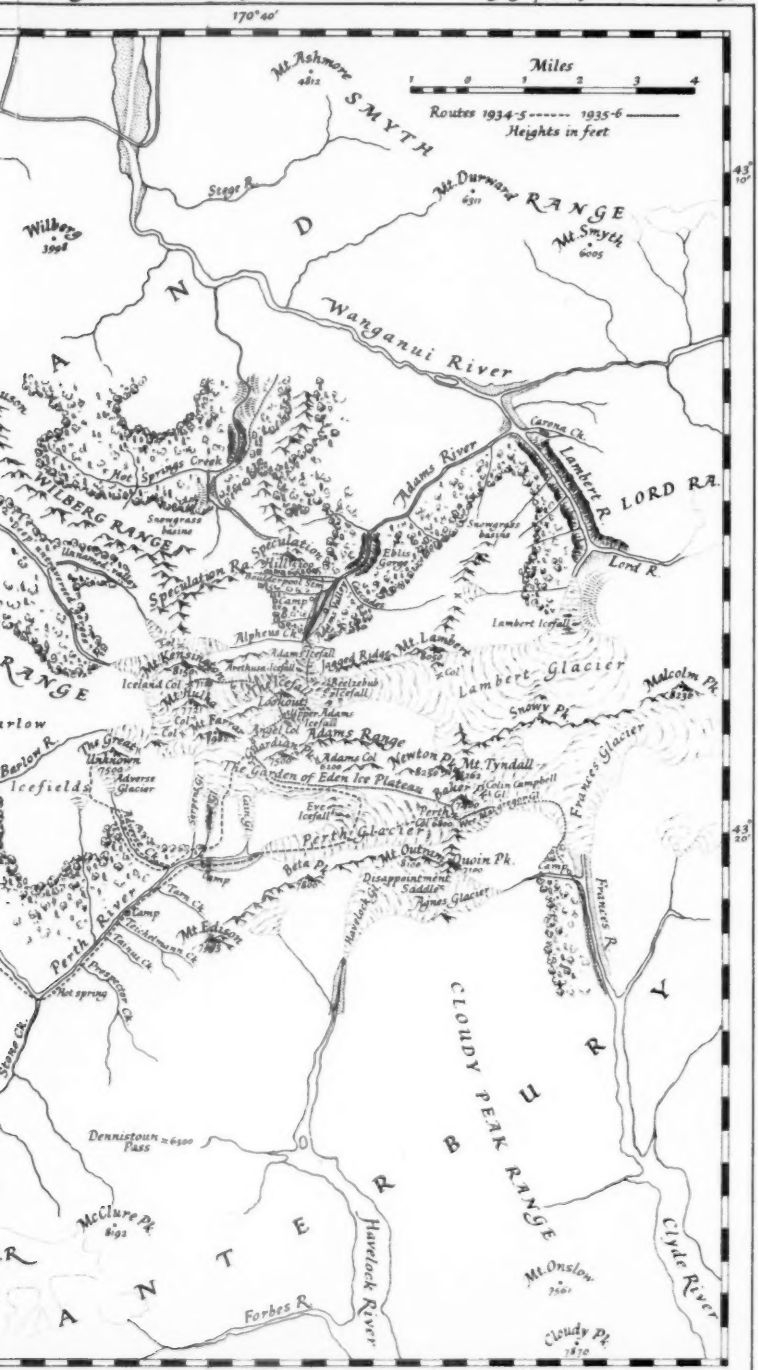

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